# HANDBOOK FOR THE RESOURCE INVENTORY OF LANDS FOR FIELD PERSONNEL ENGAGED IN MISSOURI RIVER BASIN STUDIES

UNITED STATES
DEPARTMENT OF THE INTERIOR

Bureau of Land Management
Denver, Colorado

Revised May 1963

# FIELD HANDBOOK
## CONTENTS

# Section I

## Introduction

FIELD HANDBOOK

MISSOURI RIVER BASIN GROUP
INSTRUCTIONS FOR LAND CLASSIFICATION

* "The Bureau of Land Management is responsible for the conservation management, and development of some 477 million acres of the Nation's public lands. This includes the 168-million acre national land reserve located in 27 States, plus some 309 million acres of other federally owned lands, most of which are located in Alaska.

In addition, the Bureau administers mining and mineral leasing on other federally owned lands, on former federal lands where minerals have been reserved in public ownership, and on the submerged lands of the Outer Continental Shelf".

The land classification activity of the Missouri River Basin Studies Group is governed by the code of Federal Regulations and the provisions of the Bureau Manual. The volumes of greatest interest to the land classifier are Volume V, Lands, and Volume IX, Range. This field handbook is an aid to inventory within the restrictions and policies of the Bureau procedures outlined by the manuals. It is divided into several sections; General followed by Land Classification, Range Classification, Soils, Land Capabilities, Erosion, Forestry and Tables. Each section is complete and will be revised by pen and ink, by complete removal of a page and insertion of a new one, or by replacement of an entire section of the manual.

General

The findings for land classification during inventory of a river basin are based on intensive field coverage, combined with equally intensive office research and compilation. Field inventory findings are translated into action immediately in one of two ways:

* Weekly Newsletter, Bureau of Land Management, No. 541, September 15, 1961

Appendix A.--Description, area, classification, suitability and proposed management of the national land reserve, by counties, within the Isolated Tract Classification areas of the North Platte Area, Wyoming, 1956-1959 1/ - Continued

| 6th Principal Meridian-Wyoming Twp. North | Range West | Sec. | Subdivision | Acres | General Land Character | AUM's | Present Land Use 2/ | Land Capability Classification 3/ | Principal Suitability 2/ | Proposed Management |
|---|---|---|---|---|---|---|---|---|---|---|
| **Albany County** | | | | | | | | | | |
| 25 | 72 | 33 | $NE\frac{1}{4}SW\frac{1}{4}$ | 40.00 | Gently to steeply rolling | 7 | 1 | VI | 1 | Private |
| 25 | 72 | 34 | $SE\frac{1}{4}NE\frac{1}{4}$ | 40.00 | Gently to steeply rolling | 7 | 1 | VI | 1 | Private |
| 25 | 77 | 28 | $E\frac{1}{2}$ | 320.00 | Gently to steeply rolling | 58 | 1 | VI | 1 | Private |
| 26 | 70 | 18 | Lot 3 | 40.89 | Rough and mountainous | 7 | 1 | VII | 1 | Private |
| 26 | 77 | 12 | $SE\frac{1}{4}NW\frac{1}{4}$:$SW\frac{1}{4}NE\frac{1}{4}$ | 80.00 | Gently sloping | 21 | 1 | VI | 1 | Private |
| 26 | 77 | 13 | $NE\frac{1}{4}SW\frac{1}{4}$ | 40.00 | Gently sloping | 3 | 1 | VI | 1 | Private |
| **Carbon County** | | | | | | | | | | |
| 12 | 80 | 8 | $N\frac{1}{2}SE\frac{1}{4}$ | 80.00 | Gently to steeply rolling | 18 | 1-4 | VI | 1-4 | Private |
| 12 | 80 | 9 | $N\frac{1}{2}SW\frac{1}{4}$:$SE\frac{1}{4}SW\frac{1}{4}$ | 120.00 | Gently to steeply sloping | 20 | 1-4 | VI | 1-4 | Private |
| 12 | 80 | 16 | $NW\frac{1}{4}$:$S\frac{1}{2}SW\frac{1}{4}$ | 240.00 | Steeply rolling mountainous | 48 | 1-4 | 150/VI;90/VII | 1-4 | Private |
| 12 | 81 | 3 | $NE\frac{1}{4}$:$NE\frac{1}{4}NW\frac{1}{4}$ | 200.00 | Sloping to gently rolling | 36 | 1-4 | VI | 1-4 | Private |
| 12 | 81 | 4 | $W\frac{1}{2}E\frac{1}{2}$ | 160.00 | Sloping to gently rolling | 29 | 1-4 | VI | 1-4 | Private |
| 13 | 80 | 19 | Lot 3, 4, $E\frac{1}{2}SW\frac{1}{4}$:$SE\frac{1}{4}$ | 303.95 | Steeply rolling mountainous | 40 | 1-4 | 50/VI:253.95/VII | 1-4 | Federal |
| 13 | 80 | 30 | Lot 1, $E\frac{1}{2}NW\frac{1}{4}$:$NE\frac{1}{4}$ | 271.65 | Steeply rolling mountainous | 27 | 1-4 | VII | 1-4 | Federal |
| 13 | 80 | 30 | Lots 2, 3, 4:$E\frac{1}{2}SW\frac{1}{4}$:$SE\frac{1}{4}$ | 331.77 | Steeply rolling mountainous | 33 | 1-4-SDW | VII | 1-4 | Federal |
| 13 | 81 | 1 | All | 618.26 | Steeply rolling mountainous | 98 | 1-3-4 | VI | 1-3-4 | Federal |
| 13 | 81 | 2 | All | 617.82 | Steeply rolling mountainous | 112 | 1-3-4 | VI | 1-3-4 | Federal |
| 13 | 81 | 3 | All | 620.20 | Steeply rolling mountainous | 142 | 1-3-4 | VI | 1-3-4 | Federal |
| 13 | 81 | 4 | Lot 2 | 35.86 | Gently to steeply rolling | 10 | 1 | VI | 1 | Private |
| 13 | 81 | 4 | $S\frac{1}{2}$ | 320.00 | Gently to steeply rolling | 73 | 1-3-4-PSW | 150/VI:170/VII | 1-3-4 | Federal |
| 13 | 81 | 5 | Lots 3, 4 | 75.49 | Gently to steeply rolling | 13 | 1 | VI | 1 | Private |
| 13 | 81 | 5 | $SE\frac{1}{4}NE\frac{1}{4}$:$E\frac{1}{2}SE\frac{1}{4}$ | 120.00 | Gently to steeply rolling | 31 | 1-3-4-PSW | VI | 1-3-4 | Federal |
| 13 | 81 | 6 | Lot 1 | 36.26 | Gently to steeply rolling | 6 | 1 | VI | 1 | Private |
| 13 | 81 | 7 | Lot 1:$SE\frac{1}{4}SW\frac{1}{4}$:$S\frac{1}{2}SE\frac{1}{4}$ | 153.10 | Gently to steeply rolling | 40 | 1 | VI | 1 | Private |
| 13 | 81 | 8 | $N\frac{1}{2}SE\frac{1}{4}$ | 80.00 | Gently to steeply rolling | 21 | 1 | VI | 1 | Private |

Fig. 1. Sample of summary of isolated tract classification in a sub-basin report (North Platte River in this example).

Fig. 1

Appendix A--Description, area, classification, suitability and proposed management of the national land reserve, by counties, within the Isolated Tract Classification areas of the North Platte Area, Wyoming, 1956-1959 1/ - Continued

Carbon County

| 6th Principal Meridian-Wyoming Twp. North | Range West | Sec. | Subdivision | Acres | General Land Character | AUM's | Present Land Use 2/ | Land Capability Classification 3/ | Principal Suitability 2/ | Proposed Management |
|---|---|---|---|---|---|---|---|---|---|---|
| 13 | 81 | 8 | NE¼ | 160.00 | Gently to steeply rolling | 42 | 1-3-4-5-PSW | VI | 1-3-4-5 | Federal |
| 13 | 81 | 9 | All | 640.00 | Gently to steeply rolling | 166 | 1-3-4-5-PSW | VI | 1-3-4-5 | Federal |
| 13 | 81 | 10 | N½:SE¼ | 480.00 | Gently to steeply rolling | 106 | 1-3-4-5 | VI | 1-3-4-5 | Federal |
| 13 | 81 | 10 | SW¼ | 160.00 | Gently to steeply rolling | 42 | 1-3-4-5-PSW | VI | 1-3-4-5 | Federal |
| 13 | 81 | 11 | All | 640.00 | Gently to steeply rolling | 147 | 1-3-4-5 | VI | 1-3-4-5 | Federal |
| 13 | 81 | 12 | All | 640.00 | Gently to steeply rolling | 79 | 1-3-4-5 | VI | 1-3-4-5 | Federal |
| 13 | 81 | 13 | All | 640.00 | Gently to steeply rolling | 112 | 1-3-4-5 | VI | 1-3-4-5 | Federal |
| 13 | 81 | 14 | N½:N½SW¼:SE¼SW¼:SE¼ | 600.00 | Gently to steeply rolling | 114 | 1-3-4-5 | VI | 1-3-4-5 | Federal |
| 13 | 81 | 15 | E½ | 320.00 | Gently to steeply rolling | 61 | 1-3-4-5 | VI | 1-3-4-5 | Federal |
| 13 | 81 | 15 | NW¼:E½SW¼ | 240.00 | Gently to steeply rolling | 62 | 1-3-4-5-PSW | VI | 1-3-4-5 | Federal |
| 13 | 81 | 17 | NW¼:NW¼NE¼ | 200.00 | Gently to steeply rolling | 52 | 1-4-5 | VI | 1-4-5 | Private |
| 13 | 81 | 18 | Lots 2, 3:E½NW¼:NE¼ N½SE¼:NE¼SW¼ | 427.20 | Gently to steeply rolling | 111 | 1-4-5 | VI | 1-4-5 | Private |
| 13 | 81 | 23 | N½NE¼:SE¼NE¼ | 120.00 | Gently to steeply sloping | 23 | 1-4-5 | VI | 1-4-5 | Federal |
| 13 | 81 | 24 | N½:SE¼:NW¼SW¼:E½SW¼ | 600.00 | Gently to steeply rolling | 114 | 1-4-5 | VI | 1-4-5 | Federal |
| 13 | 81 | 25 | NW¼NE¼:E½E½ | 200.00 | Gently to steeply rolling | 26 | 1-4-5 | VI | 1-4-5 | Federal |
| 13 | 81 | 29 | SW¼NE¼:SW¼ | 200.00 | Steeply rolling to rough | 40 | 1-4 | VII | 1-4 | Private |
| 13 | 81 | 29 | W½SE¼ | 80.00 | Steeply rolling to rough | 16 | 1-4-PSW | VII | 1-4 | Private |
| 13 | 81 | 32 | S½SE¼ | 80.00 | Sloping to gently rolling | 10 | 1-4 | VII | 1-4 | Private |
| 13 | 81 | 33 | SW¼:W½SE¼:NE¼SE¼ | 280.00 | Sloping to steeply rolling | 34 | 1-4 | VII | 1-4 | Private |
| 13 | 81 | 34 | NW¼SW¼:E½SW¼:W½SE¼ SE¼SE¼ | 240.00 | Sloping to steeply rolling | 29 | 1-4 | VII | 1-4 | Private |
| 13 | 82 | 1 | Lot 4 | 38.25 | Gently sloping to rolling | 12 | 1 | VI | 1 | Private |
| 13 | 82 | 2 | Lot 1, SW¼NE¼:NE¼SW¼ | 117.99 | Gently rolling to sloping | 35 | 1 | VI | 1 | Private |
| 13 | 83 | 1 | SW¼:S½SE¼ | 240.00 | Very rough mountainous | 12 | 3-4-6-7 | 150/VII:90/VIII | 3-4-6-7 | Federal |
| 13 | 83 | 2 | All | 643.20 | Very rough mountainous | 31 | 3-4-5-6-7 | 400/VII:243.20/VIII | 3-4-5-6-7 | Federal |

Public domain in small blocks and isolated by private ownership is inventoried and classified by individual unit. These classifications are forwarded to appropriate offices ( the Bureau's Land Office for the State ) for their information and possible action. This information is summarized by line entry as Appendix A in the sub-basin report. See Fig. 1 as an example. (This method of classification is by isolated tracts (IT) ).

Public domain in large blocks is inventoried with the associated private, State, and other Federal land. National forests or Indian reservations, etc, are normally exempted. These data, which are of special interest to grazing districts, are compiled on four-township sheets at 2" = 1 mile. The carrying capacities are calculated; a copy of this and an ozalid copy of the map manuscript are forwarded upon completion. (This method of inventory is area classification (AC) ).

These procedures assure prompt submission of inventory material to interested management divisions of the Bureau. Isolated tracts are reported completely. The inventory data, interpretations, conclusions, and recommendations are part of the report. Area inventory is, until the final report, in semi-final form, with only the bare inventory. Conclusions must be derived and implemented by the responsible management division of the Bureau.

Land classification and inventory thus are timely for technicians who can interpret technical notes and incorporate them into field inventory programs. Final assembly and interpretation of the data lends perspective to the reports and gives the other interested members of the Missouri River Basin Group that material of basin-wide effect referenced within the frame-work in which they work. The finished report is presented for the Bureaus

and Agencies of the Missouri River Basin.

Inventory Data

Raw data from the field for each bit of ground include; but are not limited to, description of the land - its soils, with their depths, textures, permeabilities, parent materials, slopes, degree and kind of accelerated erosion, together with the best capabilities of that soil. The native plant cover is inventoried; if it is timber, its commercial or non-commercial possibilities, species, size, crown density and stocking are itemized. If the inventory covers rangeland, then aspect and plant species are recorded by percent as to their relative abundance, and the condition of the range is determined ( present vegetation relative to the potential for the site); then the livestock carrying capacity is estimated. Notes point out special limiting factors of soils or topography, the presence of rodents or toxic or noxious plants, and the need for management changes or new programs.

These notes are also carefully plotted on aerial photographs, together with cadastral and geological survey data, cultural features such as roads, trails, fences, stock water, and future sites for water or range developments. Boundaries to which evaluations and estimates apply are located by colored lines for eventual compilation.

Stock trespass, range abuses, agricultural trespass, and inaccuracies in land descriptions are found and reported. Improvement trespass is also reported on the maps and manuscripts. Recreational areas which have possibilities are fully reported to the proper State Land Office.

The grazing districts and land offices make full use of the material. Adjudications, classifications, and disposal follow on findings

of the field crews. Field personnel also make reappraisals on land classified for disposal.

You may be curious about the distribution of the monies received by the Bureau from those lands you encounter on Missouri River Basin inventory. Millions of dollars are presented to the individual states each year, as part of this program.

| | Disposition of Receipts | | | |
|---|---|---|---|---|
| | Indian Trust | States and | Other Funds | |
| Source of Receipts | Funds | Counties | General | Reclamation |
| **Mineral leases & permits** | | | | |
| Mineral Leasing Act | - | 37.5 | 10.0 | 52.5 |
| Potash | - | 37.5 | 10.0 | 52.5 |
| LU Lands | - | 25.0 | 75.0 | - |
| **Sales of Timber** | | | | |
| Reclamation Lands | - | - | - | 100.0 |
| Public lands in "Reclamation States" | - | 5.0 | - | 95.0 |
| LU Lands | - | 25.0 | 75.0 | - |
| **Sales of Lands** | | | | |
| Public lands in "Reclamation States" | - | 5.0 | - | 95.0 |
| Reclamation lands | - | - | - | 100.0 |
| Indian Lands | 100.0 | - | - | - |
| **Grazing** | | | | |
| Taylor Act grazing leases (Section 15 - outside district) | | | | |
| Ceded Indian lands | 100.0 | - | - | - |
| Public lands | - | 50.0 | 50.0 | - |
| Indian lands | 100.0 | - | - | - |
| Taylor Act grazing districts (Section 3 - inside districts) | | | | |
| Ceded Indian lands | 66.7 | 33.3 | - | - |
| Leased lands | - | - | 100.0 | - |
| Public lands | - | 12.5 | 87.5 | - |
| Indian lands | 100.0 | - | - | - |
| LU lands | - | 25.0 | 75.0 | - |
| **All other receipts** | - | - | 100.0 | - |

# Section II

## Conduct of Survey

## Mapping Boundaries

Our report depend on accurate data gathered with imagination and thought. You will spend more time in the office than in the field so make your field time count !

Work in the field demands initiative and integrity. You usually work alone under direction of a superior, therefore, individual initiative shows up during land classification inventorying on the River Basin to a marked degree, in accuracy and quality of work and quantity of work performed.

You are in a position where you meet with the District Manager, his assistants and the public in general. Remember you are under the scrutiny of many eyes for future assignments. The public views you also with definite curiousity about the conduct of the government agency which you represent, the Bureau of Land Management.

You must be considerate of the rights of others. In range country, the rancher must know that you are crossing or intend to examine his land. On such contacts be businesslike and brief. Do not discuss the findings of your inventory with the public. Be polite, explain what you are doing, but for any answers as to Bureau policy refer the interested person to the responsible District Manager. Local people will often aid you, to an exceptional degree, in locating section corners for your control. Request such help, if it is needed, because it saves hours of search. Usually ranchers and farmers are most co-operative but - at times you may not be permitted on private land, do not force your way; refer the matter to the crew chief.

Our land classification begins at the State Land Office with land status. A records improvement program (RIP) such as that of the Montana

State Land Office makes the search rapid. The Land Office supplies townships complete with all the information pertinent to the Bureau activities. The next area of search ( of great importance) is in the County records where the more experienced employees compare our status records against the county for errors, such as conflicts in patents, or warranty deed sales, or similar title transfers. Ownership of the lands, surrounding that national land reserve which will be examined as individual tracts is determined also.

Our mapping is normally on aerial photograph with a scale of approximately 2.7 inches to the mile. The source of the photography for Missouri River Basin, at present, comes from 1953 to 1956 Aerial Photography flown by Army Map Service at a scale of 1 inch to the mile and enlarged to its present size. Adjacent photographs will vary on detail and information and total quality. A puzzling problem of photo interpretation on one photograph may be easily resolved by reference to the adjoining strip. Permanent notes are made in ink on the photographic surface - black ink for all except range types, formulas, rodent infested areas, infestation of poisonous plants and suggested range improvements, these are in red ink. Temporary streams and drainages normally will not be delineated, however, if it is important,water will be in blue ink (Rapidograph pens with Pelikan ink or "Lindy" colored ballpoints both mark well on a photographic surface. Once the notes on the surface of the photograph are permanently inscribed they are sprayed with transparent plastic spray to repel rain, sweat and dust as other areas are mapped on the photograph. Sometimes U. S. Geological Survey quadrangles cover the survey area. Field information is better interpreted on the photographs, and then transposed onto the quad sheets. This abolishes the distortion inherent in all photographs.

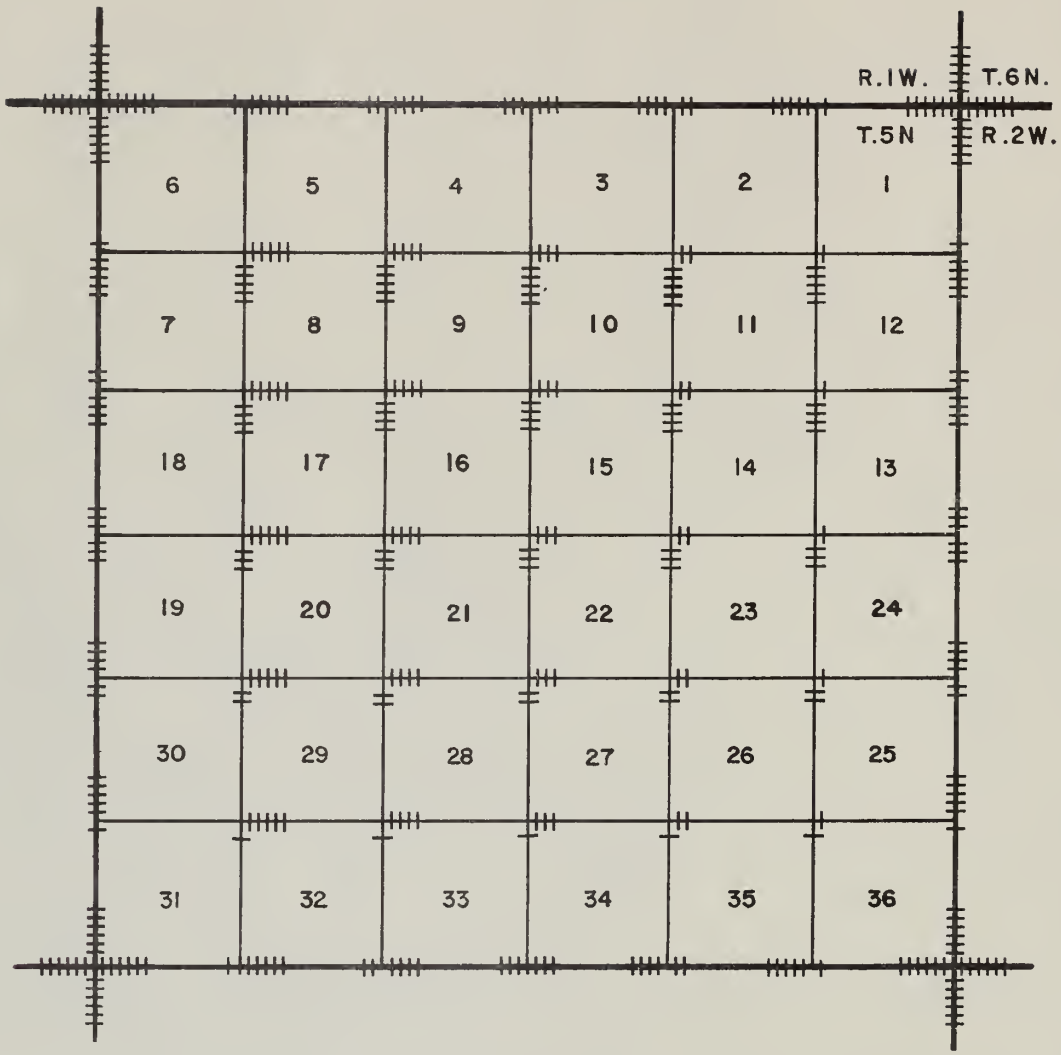
photographs.

Information is usually available on locations of pipe lines and similar rights-of-way, wherever possible these will be available at the main field office for your reference. Soils maps and geological maps for the state are also available. However, your detailed classification will often be so much more thorough, that the generalized maps of soils prepared on a statewide basis prove inadequate except to summarize large areas.

It is necessary before commencing field work to sectionize the portion of the photograph on which mapping will be done. County maps are often of such accuracy the section corner can be easily located in the field. Sectionizing a photograph is often relatively easy with help of a cadastral grid. Prominent drainages are measured the proper number of chains, from the field location of the section corner itself. This distance scaled down on plats can be compared to the same location on a photograph. The patterns of surrounding areas of cultivation often give an indication of approximate section lines.

Stone corners are usually difficult to recognize (see Fig. 2 for marking). Corners in timber are often much easier to locate, because of the blazes on the witness trees. (See Bureau of Land Management Survey Manual for markings of all corners). The location of any corner will be punctured through the aerial photograph by a pin. The holes on the reverse side of the photograph, on the back, will be identified by ink, showing the relative locations of sections in reverse, that is as they actually occur on the front of the photograph as projected through. Township and range marking, type of corner, date and your initials will identify each section corner even though it is repeated several times on the photograph. With

Figure 2. GLO System of Marking Stone Corners




On north and south lines quarter sec. corners are marked "1/4" on west face. On east and west lines quarter sec. corners are marked "1/4" on north face.

The Ordinary Markings Common to all Classes of Corners and Accessories are:

| Marks | Indicate | Marks | Indicate | Marks | Indicate |
|---|---|---|---|---|---|
| A M C | Auxillary meander corner | N | North | SW | Southwest |
| | | NE | Northeast | T | Township |
| A P | Angle Point | NW | Northwest | TR | Tract |
| B O | Bearing object | P L | Public Land | W | West |
| B T | Bearing tree | R | Range | W C | Witness corner |
| C | Center | S | Section | W P | Witness point |
| C C | Closing corner | S | South | 1/4 | Quarter section |
| E | East | S C | Standard corner | 1/16 | Sixteenth section |
| M | Mile | SE | Southeast | | |
| M C | Meander corner | S M C | Special meander corner | | |

For complete markings of iron posts and stone monuments see Manual of Instructions for the Survey of Public Lands of the United States, 1947, pages 237 to 280.

prior sectionizing accomplished partially in the office and completed in the field, land status is relatively easy to recognize.

Conflict sometimes exists between county records and Bureau records - these problems must be resolved. If such a conflict is noted on an RIP township, note the section and the conflict that exists, on the right hand side of the plat, and inform the crew chief also of the conflict that it may be resolved. Such conflicts may arise from, as an example, in Carbon County, Montana, where extensive coal mining once took place. Coal leases ( not sales of public lands) were obtained, and mines were established. Then coal mining dropped in importance and back taxes accumulated against the company. Sheriff's sales which disposed of the above-ground improvements sometimes incorrectly included the ground surface itself. A warranty deed, for the surface ( actually still public domain) was issued from the sheriff's office - The basis of the warranty deed was on the false assumption the surface was the property of the defunct coal company. For many years people have paid taxes on the authority of the warranty deed. Legal procedures are necessary to resolve such problems. Our Bureau has adequate legislation to permit such unfortunate incidence from working genuine hardships - but they must be reported by you when you encounter them.

Cadastral surveys will sometimes disagree with field findings. The usual situation is perhaps a square 640 acre section in notes, but on the ground perhaps 850 to 900 acres. We are not the survey agency, therefore, the legal acreages will be used until corrected. However, our map should show the actual acreages and on compilation for carrying capacity it should also show the actual field acreages, and the discrepancy be explained by a foot-note on a summary sheet or on any

other presentation of carrying capacities and of our base maps, so that the error may be correct, if it is essential, at some future date.

During office work whenever a question arises which only be resolved in the field, a "question book" is established in the office in which various questions are entered as they arise. This may be a query on status, or on "hanging" fences ( a fence ends illogically), a hanging road, or similar discrepancies. All of these must be checked before the field crew leaves the area the next summer. Thus office work is not only a summation and formalizing of the previous field work but planning for the future field work.

## Plotting Boundaries in the Field

Within the confines of any boundary a special set of conditions exist which are unique, differing from those surrounding. Our major problem in mapping, identification and recording are the principal boundaries of interest to our surveys, the natural ones of vegetation, soils, range conditions, etc, and the formal defines lines of cadastral survey or the political boundaries of state or county.

Boundaries simplify the problems of inventory and classification by grouping similar characters. The most important of these are Range Forage Types, Range Sites and improvement areas. The first of these, the range forage type,is a general concept dependent on the aspect of the vegetation. They are essentially broad and general; their aspect may change seasonally. Because of this, several range site boundaries will normally be found within on range type. (Distinguish between two sites or types according to instructions in the appropriate sections of this field handbook). Inasmuch as our efforts are concentrated on the range site more space will be devoted to its discussion.

Boundaries between range sites or types do not have to be traversed in the field. Most of them can be located quite accurately by very careful inspection of the aerial photographs. As the surveyor passes through the areas making notes on the vegetation prior to the final analysis he should assure himself that the boundaries are correctly located.

Any boundary should be maintained in relative position. An annoying error is that of a boundary carelessly placed on the wrong side of easily recognizable features - because most maps are normally read by reference to such landmarks. Sometimes this difficulty comes from hasty and faulty aerial photograph interpretation - sometimes it comes at the drafting table from conventionalizing a meandering line i.e., a stream

properly located relative to a section corner is sometimes "straightened out" and permanent landmarks become transposed. Occasionally we encounter this difficulty in matching adjoining surveys - watch out for this !

Range sites have distinctive characteristics which permit their mapping. Some mapping boundaries between range sites are more important than others. For example, Saline Lowland, which has a high carrying capacity, must be separated from Saline Upland, yet both have highly alkaline soils. The more important the boundary the smaller is the minimum size of the area which is enclosed. This rule can be seen as applying to sterile playas with exceptionally saline soils; barren rocks outcropping at the surface, stabilized dunes and meadows. For example on a two inch to the mile grazing map it is necessary to show tiny meadows which have a bearing on allotment and adjudication by district managers. The same criteria would apply to areas of extremely low production such as Barren types. On maps of smaller scale the importance of these is lessened and small areas are dropped out because of a shift of emphasis and intent of the smaller scale map.

Most difficulty arising in proper expression of boundaries is the mapping by localized faciations rather than first recognizing a general pattern. Look for areas which are as large as possible and yet preserve their unique reason for being separated. Small types are difficult, you can subdivide and redivide areas to the point where it becomes impractical to produce a map ! First - recognize the general pattern of landforms and vegetation in your mapping unit. Decide on the pattern of all the various microclimates within the site (your photograph will help on this) then decide where the boundaries shall be. A line between two vegetative

range types is less significant than one between range sites; variations within a range forage type are normally picked-up by range sites and carrying capacity boundaries.

We have those very important boundaries between range sites which vary considerably in forage production. These are often easily traced both on the ground and on the aerial photograph. A boundary problem arises when the boundaries are not sharp but represent gradual integrations. This is often true within a large range site which grades slowly with a gentle transition from a high carrying capacity to a noticeable lower one, as stock water is approached. At some point along this gradual change a line must be drawn dividing the two extremes. As it is with all averages - this boundary is difficult to place on the map; it cannot be precise, but it should be placed only after a sufficient examination proves that it will represent the differences in the two areas. This line would, of course, be represented by long-dashes. Before the final line for range sites type or carrying capacity is made in the field tentative boundaries sketched on the surface of the map with accompanying notations are a great help in the final placement.

Some confusion may result because of the necessity of your including one or several small range sites within an all encompassing one. This situation, when it arises, should be explained in the field notes but no effort should be made to delineate too-small range sites even though they make up 10 to 20 per cent of larger ones. In desert areas it may become necessary to use a composite symbol of two range sites i.e., (Sands - Dense Clay (Sa - Dc) inasmuch as the two sites may each contribute half yet it would be impossible or at least impractical to separate them. The question of boundaries often arises where great vegetational differences exist between north-south slopes or on east-west

slopes. Such differences usually should not be mapped but rather be averaged together. This means, therefore, you must have a definite idea of what you mean to present; then you will recognize how to present it.

Topographic differences are easy to recognize and map. This gives rise to over-mapping and introduction of overmuch detail in areas of high relief. Make a careful evaluation by studying the average of such country on your photograph. Relative acreages may be estimated and actual mathematical comparisons be made between two sites that excessive detail may be avoided. This detail can often better be expressed in notes in the narrative portion. These notes should be prepared in an average area - over-lush vegetation or barren slopes will lend such a strong note to the character of the landscape unconsciously you will emphasize the immediate surroundings rather than the area average. Therefore, evaluate the vegetation, the soils, types, sites and other information within each boundary in a representative area after a sufficient portion of the area within the boundary has been traversed. Sufficient notes should have been made during your inspection so that a good analysis may be formulated and recorded.

Each surveyor will check his mapping where it joins others to assure the proper range site, type, and subtype boundaries, as well as the obvious features, join perfectly. Stream flow should be indicated by an arrow as it leaves the photograph. Joins should be edited most carefully. These matching checks are a great responsibility. It is here that draftsmen will have the most difficulty interpreting and correcting errors. Therefore, be certain all edge matches are proper and good. Do not over-map boundaries onto adjoining photographs.

In summatior certain boundaries are more important than others;

boundaries between two sites varying widely in productivity are the more important lines. The more important the boundary, the smaller the size of the area which it may enclose. As sites and types have distinctive characteristics, boundaries of transitional areas are averaged. Relative location of boundaries is most important in relation to landmarks. Evaluate your area within representative portions delineated by that boundary. The goal of the surveyor is to recognize the overall pattern of the major units and present that pattern, not a hodgepodge of little units which obscure the general pattern. This will avoid the problem of over-typing or the attendant bad problems of under-typing. The boundary line is a critical point of the presentation of much of the data and must receive consequent attention in the field.

# Section III

## Soil

## Slope, runoff, depth, texture, permeability, parent material

Soil, as recognized by the Missouri River Basin field crews for field classification, is that medium which supports land plants. We determine those minimum physical or chemical characteristics of the soils which affect our Bureau's land use, management, or land classification. Because most of the classification is on land in native plant cover, the soils themselves are thus usually described as components of the range site and range type. Occasionally, in agricultural classification, the soil will be the major consideration for our decision, but more often the soils classification serves only to make explicit the environmental factors on which the range site with its carrying capacity, was developed.

A cross-section of soil will show its development. Development is the existence of a profile, as in Fig. 3 ( from Soil Survey Manual, U.S.D.A. Page 175). Soils develop from weathered rock and parent material accumulated primarily through rock weathering. Rocks by virtue of their mineral composition will influence the texture, the mineral content, and color of the soils. However, the soils, the vegetation, and the climate interreact - soils affect the vegetation, vegetation affects the soil, and both are dependent on the climate. Rain as it falls or water as it percolates carries material from the surface depleting the upper soil profile. Vegetation will carry minerals from the lower profiles to the surface in general by this action broadleafed trees and grasses create and maintain a basic soil; conifers in acid soil. The vegetation, of course, is an expression of the climate. Lower in the profile minerals and fines accumulate from those in the soil profile above. The depleted zone at and near the surface is the "A" horizon, the zone of

accumulation is the "B" horizon. The "C" horizon is the weathered parent material, and "D" is the underlying sub-stratum of rock.

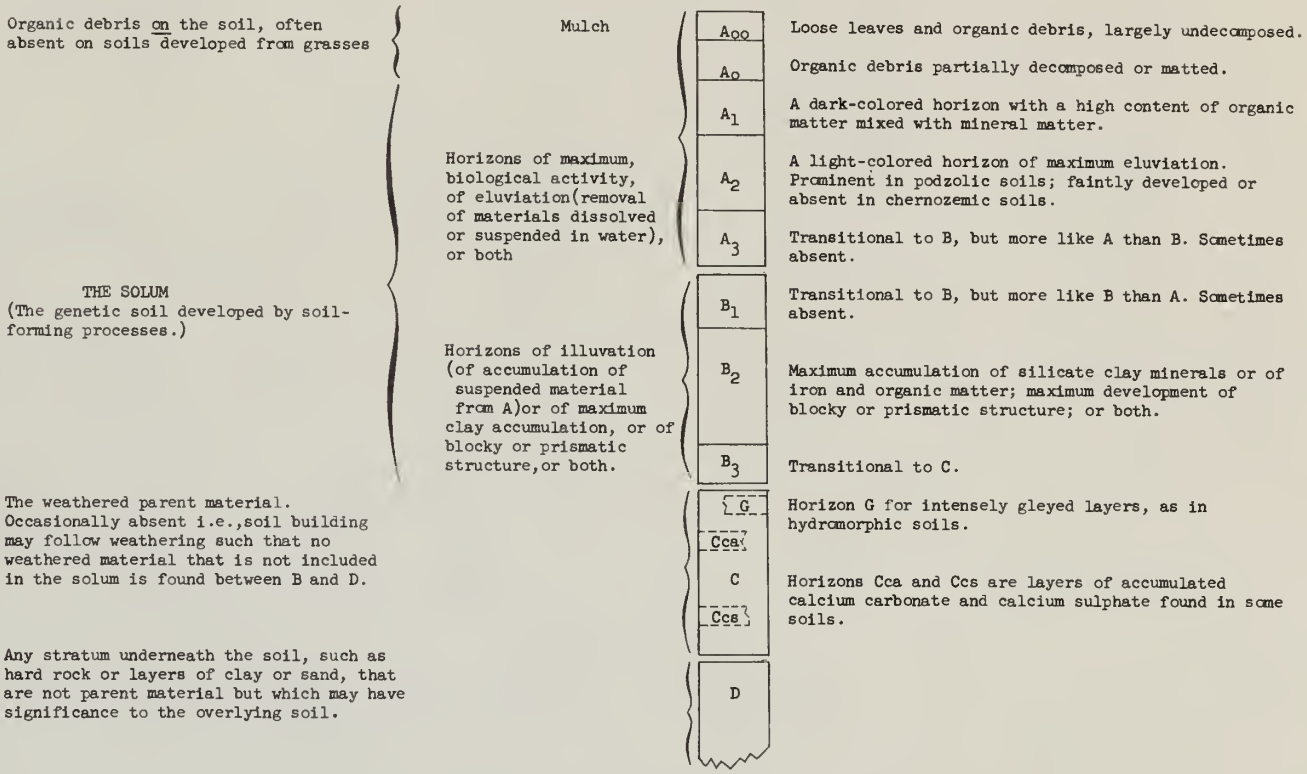



Figure 3. - A hypothetical soil profile having all the principal horizons. It will be noted that horizon B may or may not have an accumulation of clay. Horizons designated as Cca usually appear between $B_3$ and C. The G may appear directly beneath the A.

This terminology is common in discussion of soils. Our classifications are based principally on the "A" "B" and "C" horizons in regards to permeability of the soil, erosion, yields of vegetation and related questions.

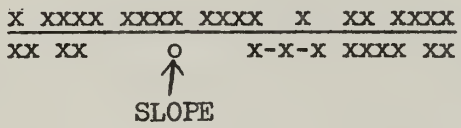
The same parent material will develop radically differing profiles under dissimilar climates or even in differing topographic positions. Our c assification does not extend to that of the great soils group, it is restricted to recording simple characteristics of the soils that effect our decisions. The field office library has books with detailed explanation of the classification and development of the soils group, and their typical profiles. This is required reading for our trainees and career conditional

employees for a background on soil.

Many observations included in our soil information are part of our description of the range site. If the range description is not covered in the standard determinations included under soils, then you must expand the descriptive formula, prepared at the time of inspection, into narrative notes on the back of the vegetative writeup.

Slope

Position in Formula




The slope of the land is of great importance. It is the overall average of an area. On occasion, within a large range site, a small included area may depart radically from the average slope. A note to this effect will be made by hachures on the map or by a narrative statement rather than attempting to delineate this small area.

Soil slope is given in terms of percent -- the ratio of the vertical rise in feet to each one hundred feet of horizontal distance. One percent of slope means a rise of 1 foot in 100 feet ( a slope of 45 degrees is 100% because the difference in elevation is one hundred feet rise for every hundred feet of horizontal distance).

"A" Class Slope Level or nearly level soils areas where runoff is slow or ponded, very slow. 0-3%. Describe a single slope as level or nearly level, a complex series of slopes as level or nearly level.

"B" Class Slope Gently undulating or gently sloping soil areas. 3-8%. Generally describe single slopes as very gently sloping, or gently sloping. Complex slopes are described as undulating or gently undulating.

"C" Class Slope. These are gently rolling, moderately to strongly sloping soil areas. Slopes range from 8-16%. Describe a single slope as sloping or strongly sloping, complex slopes as rolling, gently rolling or strongly rolling.

"D" Class Slope. These slopes are very strongly sloping and hilly soil areas. They range from 16-30%. Describe a single slope as moderately steep, steep complex slopes as hilly.

"E" Class Slope. Here are steeply sloping and very hilly soil areas. In fact, sometimes soil is present only as pockets in very shallow and rocky areas. Slopes vary from 20-65%. Describe a single slope as steep; complex slopes describe as steep hills.

"F" Class Slope. Above 65%. Severe slopes. Complex slopes will be described as extremely steep and hilly.

Runoff

Position in Formula

x xxxx xxxx xxxx x xx xxxx
xx xx xx x-x-x xxxx o
↑
RUNOFF

Runoff is external soil drainage. Occasionally called surface runoff, it is the relative rate in which water is removed by a flow over the surface of the soil. Six classes of surface runoff are used, which will be determined from the soil itself, the slope, the climate, and very important, the vegetative cover. Determination is relative and not exact.

1 - Ponded. Seldom used and of little importance. No escape from the area. Internal drainage, as in playas or temporary lake bed. Flat level areas.

2 - Very Slow. Surface water flows away very slowly. Free water lies on the surface. Much of the water passes into the soil or evaporates. Soils will be level to nearly level, or very open and porous as in loose sand.

3 - Slow. Surface water flows away so slowly free water will cover the soil for a long period or enter it very rapidly. A large amount passes down into the soil profile or evaporates. Normally there is little or no erosion on this site; it should represent either a very level saline flat or very light, sandy soil.

4 - Medium. Surface water flows away at a rate that a moderate portion of the water enters the soil profile or free water lies on the surface only a short time. A large part is absorbed by the soil and used for plant growth. This would be true of silty, sandy and clayey soils. Level to gently rolling "B - C" slopes.

5 - Rapid. A large part of the surface water moves rapidly over the soil only a small part moves into the soil profile. These are usually moderately steep to steep slopes from about 10 - 45% in grade. The erosion hazard is moderate to high. This would be characteristic of many of the level shale and dense clay soils.

6 - Very Rapid. Most of the water moves rapidly over the surface, and only a very small part goes into the profile. These slopes run 10-65% and the soils occur in thin breaks, where the rocks contribute to a very rapid runoff, or in badlands or shale range sites.

Soil Depth

Position in Formula

| x xxxx xxxx xxxx x xx xxxx |
|---|
| xx xx xx x-x-x oxxx xx |

↑
SOIL
DEPTH

Soil depth usually refers to development of the soil profile from the surface down to the "C" horizon or parent material. It is of especial significance in crop and native plant yields.

Our classification depth includes both agricultural and non-agricultural lands and will be within the agricultural definition. However, when the soil is non-agricultural because of climate or obstructions, such as cobbles in the profile, then the soil will be a range site or forest and the depth should be that of the limit of root growth on native range vegetation. Very rocky ground, as in a terminal moraine, left by glacial action, may have deep soil, in the interstices of the rock, capable of exploitation by native plants. This soil would be incapable of use by agricultural crops hence classified as very shallow - yet most productive of native vegetation for use by livestock and wildlife or for timber production.

| Formula Symbol | Description | Depth in Inches |
|---|---|---|
| 1 | Very Deep | over 60 |
| 2 | Deep | 36-60 |
| 3 | Moderately Deep | 20-36 |
| 4 | Shallow | 10-20 |
| 5 | Very Shallow | 0-10 |

Soil Texture

Position in Formula

x xxxx xxxx xxxx x xx xxxx
xx xx xx x-x-x xoxx xx
↑
SOIL
TEXTURE

Soils are described in terms of texture. The formal classification follows at the end of the section for your information as to the basis for texture classification. Soil texture is relatively easy to determine in the field. However, your field determinations will

at times be at variance with laboratory analysis. Usually such contradictions are minor and depend on interpretation versus strictly mechanical classification. The following suggestions are excellent ones for you to use in the field.

"Sandy soils, even very fine sands, have a characteristic gritty feel when rubbed between the fingers. In contrast, dry silts, like rock flour, have a smooth, silky or floury feel. Some clays when wet, feel slick, or even soapy." 1/

"The bite or grit test is a quick and useful method of identifying sandy silt, or clay. In this test, a small pinch of the soil material is ground lightly between the teeth and the soils are identified as follows; (a) Sandy soils: The sharp hard particles of sand will grate very harshly between the teeth and will be highly objectionable. This is even true of fine sand. (b) Silty soils: The silt grains are so much smaller than sand grains that they do not feel nearly so harsh between the teeth and are not particularly objectionable, although their presence is still easily detected. (c) Clayey soils: The clay grains are not at all gritty, but feel smooth and powdery (like flour) between the teeth." 2/

1/ TM 5-541 Control of Soils in Military Construction

2/ Soils Engineering Extension Course U. S. Army Engineer School.

The soil surveyor's of the Department of Agriculture have used this: "The soil must be well moistened and rubbed vigorously between the fingers for a proper designation of textural class by feel.

For many years, the field determination of soil textural class actually took precedence over the results of mechanical analyses, which served only as general guides. Some 25 years ago the late Professor C. F. Shaw worked out the following definitions of the basic soil textural class in terms of field experience and feel:

Sand: Sand is loose and single-grained. The individual grains can readily be seen or felt. Squeezed in the hand when dry it will fall apart when the pressure is released. Squeezed when moist, it will form a cast, but will crumble when touched.

Sandy Loam: A sandy loam is a soil containing much sand but which has enough silt and clay to make it somewhat coherent. The individual sand grains can readily be seen and felt. Squeezed when dry, it will form a cast which will readily fall apart, but if squeezed when moist a cast can be formed that will bear careful handling without breaking.

Loam: A loam is a soil having a relatively even mixture of different grades of sand and of silt and clay. It is mellow with a somewhat gritty feel, yet fairly smooth and slightly plastic. Squeezed when dry, it will form a cast that will bear careful handling, while the cast formed by squeezing the moist soil can be handled quite freely without breaking.

Silt Loam: A silt loam is a soil having a moderate amount of the fine grades of sand and only a small amount of clay, over half of the particles being of the size called "silt". When dry it may appear cloddy but the lumps can be readily broken, and when pulverized it feels soft and floury. When wet the soil readily runs together and puddles. Either dry or moist it will form casts that can be freely handled without breaking, but when moistened and squeezed between thumb and finger it will not "ribbon" but will give a broken appearance.

Clay loam: A clay loam is a fine textured soil which usually breaks into clods or lumps that are hard when dry. When the moist soil is pinched between the thumb and finger it will form a thin "ribbon" which will break readily, barely sustaining its own weight. The moist soil is plastic and will form a cast that will bear much handling. When kneaded in the hand it does not crumble readily but tends to work into a heavy compact mass.

Clay: A clay is a fine textured soil that usually forms very hard lumps or clods when dry and is quite plastic and usually sticky when wet. When the moist soil is pinched out between the thumb and fingers it will form a long, flexible "ribbon". Some fine clays very high in colloids are friable and lack plasticity in all conditions of moisture.

Such definitions are suggestive only. None could be made in these or similar terms that would apply adequately to all soils. Variations in the kind of clay mineral and in the proportion of different exchangeable cations in the clay are too great among the great soil groups. Such kinds of definitions are limited to a group of similar soils"

1/ "The need for fine distinctions in the texture of soil horizons results in a large number of soil textural classes. Often it is convenient to speak generally of a broad group of textural classes. Although the terms "heavy" and "light" have been used for many years, they are confusing since the terms arose from the power required in plowing, not the actual weight of the soil. According to local usage in a few places, "light" soils are those low in productivity, including especially ones of clay texture.

An outline of acceptable general terms, in three classes and in five, in relation to the basic soil textural class names, is shown as follows:"

| 2/ General Terms | | Basic soil textural class names | Formula Symbol | Description |
|---|---|---|---|---|
| Sandy soils. - | Coarse-textured soils..... | (Sands<br>(Loamy sands | C | Very Light |
| | Moderately coarse-textured soils.... | (Sandy loam<br>(Fine sandy loam | L | Light |
| Loamy soils. - | Medium-textured soils..... | (Very fine sandy loam<br>(Loam<br>(Silt loam<br>(Silt | M | Medium |
| | Moderately fine-textured soils.. | (Clay loam<br>(Sandy clay loam<br>(Silty clay loam | H | Heavy |
| Clayey soils.- | Fine-textured soils..... | (Sandy clay<br>(Silty clay<br>(Clay | V | Very heavy |

Note: Missouri River Basin practice is the addition of two other classes "F" Moderately Heavy, (between "M" and "H") and "S" Moderately Light, (between "L" and "M").

1/ U. S. Department of Agriculture Soil Survey Manual - Handbook #18

2/ U. S. Department of Agriculture Soil Survey Manual - Handbook #18, slightly modified.

Fig. 4 illustrates the difference in texture resulting in variances of the three primary soil components.

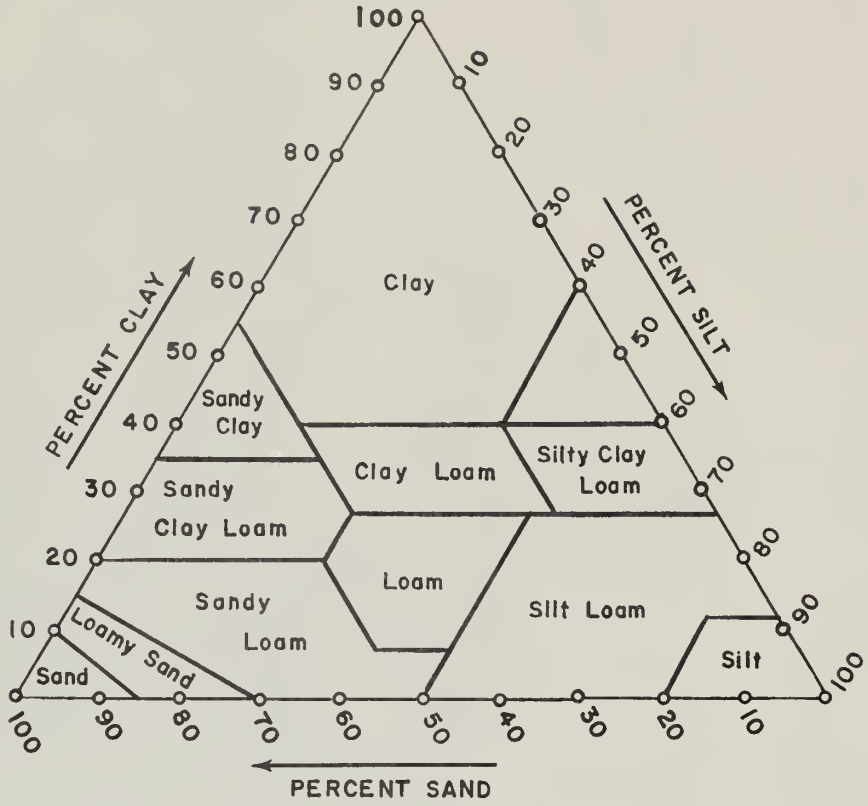



Figure 4. - The texture triangle shows the percentage of sand, silt and clay in each of the textural classes.

"The terms for coarse fragments,are also added as adjectives to the soil class name and become a part of it. Thus a "gravelly sandy loam" has about 20 percent or more of gravel in the whole soil mass. The basic soil textural class name, however, is determined from the size distribution of the material below 2mm. in diameter.....
In addition to these basic soil textural class names, modified according to the size group of the sand fraction, other terms are also added as modifiers. Muck, peat, mucky peat and peaty muck are used in place of the textural class names in organic soils - muck for well-decomposed soil material, peat for raw undecomposed material, and peaty muck and mucky peat for intermediate materials.....1/

1/ U. S. Department of Agriculture Soil Survey Manual - Handbook # 18

Permeability

Position in Formula

x xxx xxxx xxxx x xx xxxx
xx xx xx x-x-x xxox xx
↑
SOIL
PERMEABILITY

"In the absence of precise measurements, soils may be placed into relative permeability classes through studies of structure, texture, porosity, cracking, and other characteristics of the horizons in the soil profile in relation to local use experience... Commonly, however, the percolation rate of a soil is set by that of the least permeable horizon in the solum or in the immediate substratum.
The infiltration rate, or entrance of water into surface horizons, or even into the whole solum layer directly beneath the solum that influences water movement within the solum itself. The rate of infiltration and the permeability of the plow layer may fluctuate widely from time to time, because of differences in soil management practices, kinds of crops, and similar factors.

Sets of relative classes of soil permeability (based on rates through saturated undisturbed cores under a ½ inch head of water) are as follows:" 1/

1/ U. S. Department of Agriculture Handbook #18, slightly modified.

| Formula No. | Descriptive Term | Infiltration Possible rates in inches per hour |
|---|---|---|
| Slow: | | |
| 1 - | Very slow | less than 0.05 |
| 2 - | Slow | 0.05 to 0.20 |
| Moderate: | | |
| 3 - | Moderately slow | 0.20 to 0.80 |
| 4 - | Moderate | 0.80 to 2.50 |
| 5 - | Moderately rapid | 2.50 to 5.00 |
| Rapid: | | |
| 6 - | Rapid | 5.00 to 10.00 |
| 7 - | Very rapid | over 10.00 |

Parent or Underlying Material

Position in Formula

x xxxx xxxx xxxx x xx xxxx
xx xx xx x-x-x xxxo xx
↑
UNDERLYING
MATERIAL

Underlying the soil is the parent material from which the soil is derived. Occasionally the soil is transported into place and the underlying material differs from that of the parent material. The underlying material listed for each soil will be that of the "C" horizon.

| | | | |
|---|---|---|---|
| A | Acid igneous rock | N | Marl or chalk |
| B | Basic igneous rock | O | Silt or mustone |
| C | Chert or flint | P | Peat |
| D | Loess or aeolian material | Q | Sand |
| E | Shale or slate (acid) | R | Caliche |
| F | Sandstone | S | Unconsolidated material (describe locally) |
| G | Glacial material | T | Old alluvium, terrace, or outwash, alluvial cones, or valley fill |
| H | Gypsum | U | Colluvial material |
| I | Schist | V | Lacustine material |
| J | Quartzite | W | Greensand (glauconite) |
| K | Shale or slate (alkaline) | X | Recent alluvium and recent outwash |
| L | Limestone | Y | Clay |
| M | Muck | Z | Gravel |

A. Acid igneous rock

These igneous rocks are light in color, feldspars predominate. Underlying material in this class includes Granite, Diorites, Andesites, Rhyolites, Felsites, Obsidians, Pitchstones, and Pumices. The acid igneous rock will, as soil develops, tend to influence the final product - a lighter textured soil favoring certain types of vegetation.

B. Basic igneous rock

Basic igneous rock is easily recognized, all rocks in the group are dark colored because of the great concentration of ferromagnesian

minerals. The soil developing from dark basic igneous rock is influenced by this specialized mineral content, and affects the vegetation accordingly. Basic igneous rocks include commonly Gabbros, Dolerites, Basalts and the mineral forms which often make large deposits Peridotites, Hornblendites, and Pyroxenites. Basic igneous rocks are heavier (higher specific gravity)than are the acid igneous rocks.

C. Chert or Flint

Chert or flint are generally inclusions in another material such as sandstone or mudstone. Rarely encountered in our area of inventory these are dense structureless rocks with conchoidal fractures.

D. Loess or aeolian material

Loess is yellowish, soft earthy, fine-grained sediment - with little horizontal stratification but with pronounced rough vertical cleavage which can form high sheer bluffs. Loess is extremely fine-grained and but little decomposed. Erosion of the yellow silt of China gives the Yellow River and the Yellow Sea their names. Soils developed from loess are deep and fertile.

E. Shale or Slate (acid)

Shales are grey, occasionally red or pink, very fine-grained, soft usually easily scratched, formed from clays at the bottom of lake beds. Slate is much harder, splits into planes readily and is in some demand as roofing material.

F. Sandstone

Sandstone comes in a wide range of colors, greys, yellows, reds and browns. This stone is composed of firmly cemented sand grains,

the grains easily determined by gently biting the rock, the grains are immediately recognized by the grating on the teeth. The cementing material between the grains determines whether the rock is soft or hard, easily weathered or weathered only with difficulty. Soils derived from sandstone are light (sandy).

G. Glacial Material

Glacier material is an unconsolidated mass. Large boulders are intermixed with fine material. Native vegetation exploits glacial material as a deep soil because the roots can penetrate the interstices between the boulders. Sometimes sediments are sorted by runoff water from the glacier.

H. Gypsum

Gypsum is a very soft mineral encountered often in semi-arid climates, it is soft, white, shiny easily scratched with the fingernail. Vegetation is much affected on soils derived from gypsum because of the chemical reactions.

I. Schist

Schist is a metamorphosed igneous rock that looks like slate. It has parallel cleavage, it's plane surfaces are quite shiny.

J. Quartzite

Quartzite is a metamorphosed sandstone. The sand grains are no longer apparent. It is dense and most resistant to weathering.

K. Shale or Slate (alkaline)

Shales or slates alkaline in reaction resemble acid shales and slates but are recognized by the characteristic halophytic vegetation produced.

L. Limestone

Limestones colors vary, greys are most common. This is a rather

soft, dense rock easily eroded by water forming the characteristic terrain. Soils derived from limestone often have good physical structure because of the high calcium content.

M. Muck

Muck is underlying material high to extremely high very well decomposed organic material.

N. Marl or chalk

Marl or chalk is a very soft highly calcareous material derived from shells (marl) or from skeletons of tiny microscopic animals (chalk). The calcareous content gives good soil structure and influences vegetation, i.e. grasslands in the Black Belt of Alabama in 50" precipitation.

O. Silt or Mudstone

Silt or mudstones are sedimentary rocks developed from deposits of silt, very fine textured soil, or even finer textured clays. Soft and stony material and readily decomposed - derived soils are medium to heavy texture.

P. Peat

Peat is very high in organic material slightly decomposed.

Q. Sands

Sand is the loose unconsolidated quartz grains of varying sizes.

R. Caliche

Caliche is devloped from soft highly calcareous material grey to white, easily compacted. Caliche is normally formed in place by leaching with accompanying accumulated lime carbonates in the lower profiles of the soil. It is not rocklike.

S. Unconsolidated (describe locally).

Unconsolidated material may be terraces or some similar geologic deposit, you will describe its physical character.

T. Old Alluvium

Old alluvium, terrace or outwash, alluvial cones or valley fill. Alluvium is deposited by water. It may be fine textured deep full of large stone and boulders depending on distance of transportation. Much of the material is unconsolidated. Expand your notes and comments on "T" as you would for "S".

U. Colluvium

Colluvial materials are deposits, usually at the base of foothills and mountains, which were depozited by the action of frost-heave, gravity, etc alone. Normally large sized rocks and stones will little fines between, as opposed to glacial and alluvial deposits.

V. Lacustrine

Lacustrine materials are those deposits settled out of quiet lake waters. A good example of this would be a playa or dry lake basin.

W. Greensand(glauconite)

Greensand is seldom encountered in our area of survey.

X. Alluvium (recent)

Recent alluvium and recent outwash is perhaps fertile and deep, it is a new material excavated and redeposited by water.

Y. Clay

Clay, fine textured soft material

Z. Gravel

Gravel, rounded or angular fragments not prominently flattened up to about 3 inches in diameter, with no or little fines.

# Section IV

## Erosion

## Wind, Sheet and Gully

Accelerated erosion is the only type you will classify. Geological erosion, often important, will be separately described in your narrative.

Before the amount of soils removed through erosion may be estimated, remember than on many soils, lithosols for example, soil development has been so little as to constitute no appreciable evolvement of the soil profile. Therefore, an attempt to recognize erosion class on this would reveal very little profile, and an inexperienced surveyor would classify the area as having much of the topsoil removed, whereas in reality, it had never developed. Keep in mind in classifying accelerated erosion, that the lack of a soil mantle possibly may be due to the fact one has never been formed - not that erosion is severe. A thin soil mantle may be an expression of a particular type of parent material and light rainfall. Mere thinness of a soil is not an indication of a severe state of erosion.

A relict soil under relict vegetation can be the basis for comparison of the soil depth and development between two areas providing they are similar sites and under the same range conditions. Even so comparisons between virgin areas and those where erosion is suspected are sometimes inconclusive. To cite an example, a relict in Idaho was isolated from all outside use by a lava flow at approximately the time Columbus was sailing towards the Caribbean. Yet in that relict erosion, by our standards, would be "moderate" for the 188 acre tract. Therefore, virgin soil profiles in themselves are guides to be used with other evidence. Pedestaling, for example, is such evidence to indicate the amount of soil removed

The height of the pedestal to original soil level as indicated by the plant crown is often a good determinant of the amount of removal. Exceptional care must be taken, when pedestaling is used, the original surface is not confused with deposition through wind erosion around the base of the shrubs thus establishing false base lines many inches or even feet above the norm of the soils. Erosion in itself is one of the more difficult determinations we must make.

Spectacular erosion scars may occur in a period of abnormal moisture, the subsoil becomes saturated, greasy, the entire soil will slip leaving a large barren area. Subsequent erosion from this barren area may or may not go on, but the basic reason of a slip must be understood and appreciated so that these barren scars on the hill and mountain sides are understood in relationship to geological erosion.

In itself erosion may not necessarily reduce productivity. Malin cites areas in western Kansas where wind erosion having taken 90% of the topsoil, was judged at the time of erosion survey ( early 1930's) as being incapable of further crop production - yet but three years later topped the state for wheat production. This is not to decry the evident ill effects which are true in erosion loss, but to adjure each surveyor that he report an average condition within each boundary, and not be swayed unduly by the small, spectacular areas of erosion, which, if visually outstanding, may result in over-estimated erosion condition overall. Erosion is the average within the site. If an exceptional instance necessitates special mention, it can be done in the form of notes on the map or narrative.

It is important that judgement in the field is an evaluation of the fact, against an adequate background. Know the history of the area, for example, the spectacular erosion.

A statement in the Soil Survey Manual of the Department of Agriculture is, "A soil scientist must guard wholly as much against exaggeration of accelerated erosion as against failure to recognize it where it is significant". *

Reporting Erosion

Three classes of erosion will be divided into phases according to the following outline. Differentiation between the phases is on intervals of 25% soil removal, because estimates of erosion cannot differentiate smaller intervals of erosion. This opinion is supported by the official soil mapping agency of the United States, its soil scientists do not estimate closer than an average of 25% increments of removal within the boundary of the soil.

Water Erosion

Gully erosion is the extreme form of water erosion, factors opposing or hindering gully erosion and factors favoring it are the same as those which would effect sheet erosion. Gully erosion implies, however, an additional factor - that of concentration of water into streams which possess a mechanical transportation of soil and small particles of gravel in such a way as to excavate the material through its own action. Factors which favor sheet erosion will have sufficient runoff water to concentrate and thus favor gully erosion. Objects which hinder water-runoff,such as plant cover, will usually reduce gully erosion. Sheet erosion actually occurs from tiny particles of soil being dislodged and thrown into the air by the impact of rain drops falling from above, as they fly through the air they drop to a lower position and are either carried off by runoff or are displaced sufficiently to constitute removal from the soil where it started. The result is

* U. S. Department of Agriculture Handbook #18, Soil Survey Manual, Page 253.

pedastaled soils. Here plant cover reduces sheet erosion by breaking the impact of the raindrops. Some gullies have their genesis in "piping". Piping originates from runoff water entering saline soil in rolling topography. The water dissolves channels and sinks which coalesce into large tunnels. Eventually steep-sided gullies are formed which attain badlands proportions. Piping occurs independent of the quantity of plant cover. Although piping is widespread in the area of our classification plant cover is still the most influential means of determining and controlling erosion.

Occasionally a soil may become so saturated it will creep down a slope because of the lubricating qualities of the wet soil at the base of the mass, making huge erosion scars. However, sheet, rill and gully erosion are the three forms of water erosion to be classified- (include rill erosion with sheet erosion). Land slumps and slides are geological erosion and will be described, not classified.

Sheet Erosion

Sheet erosion is more or less uniform removal of soil from the area without development of conspicuous water channels. It is the most widespread of any type of erosion. Recognize it by thinning surface soil layers, or small spots from which all surface soil has gone - accompanied very often by an accumulation of eroded soil at the foot of the slope, or banked up against rocks and sticks which happen to be crosswise on a slope. Rill erosion, which is included with sheet, has small but conspicuous water channels which are minor concentrations of runoff.

Class I. None to Slight. Up to 25% of the A horizon may be removed. Note: The A horizon may be very thin in most of the desert soils which comprise much of the basins surveyed by Missouri River Basin teams.

Class 2 Slight to Moderate. 25 to 75% of the A horizon has been removed. If the horizons are difficult to determine just use the top 5 to 8 inches of soil for your estimate, thus a removal of the surface soil from $1\frac{1}{4}$ inches to 3 3/4 inches on a 5 inch depth or 2 to 6 inches removed for the 8 inch depth. ( The 8 inch depth would be used only in those areas where the rainfall is higher with consequent greater developement of the profile.)

Class 3 Moderate to Severe erosion. All or practically all of the top 5 to 8 inches has been removed. If an "A" horizon has developed perhaps all of it, plus part of the "B" is removed.

Class 4 Sheet Erosion, "Severe to Critical" is normally impossible to map. At this stage gullying has taken over to the point that the area is an intricate mass of small or medium sized gullies.

Wind Erosion

As is seen in Table 1 on Erosion, wind erosion is not important in humid regions but within the sub-basins of the Missouri River Basin it is one of our major sources of erosion. Wind erosion is caused by high winds lifting up fine soil particles. Coarser particles are rolled or hopped along the surface, by the wind, sometimes cutting away vegetation which enables the wind to sweep more fiercely and increasing the amount of dirt in motion. Finer particles, as in silt, blow out easily. Wind erosion has two classes: removal and ( unlike water erosion) deposition. Hummocks (deposition) are usually in the same area as the removal.

Class 1 None to Slight. Using 5 to 8 inches as top-soil up to 25% amount of removal ( $1\frac{1}{4}$" - 2") would be "none to slight".

Class 2 Slight to Moderate. A removal of 25 to 75% ( 1¼" - 3 3/4" to 2" - 6") of the 5 to 8 inch soil with the same depths as in sheet erosion.

Class 3. Moderate to Severe. This class is removal of all of the top 5 to 8 inches plus occasionally some of the underlying soils.

Class 4 Severe to Critical. The soil is blown-out land ( Note: this classification will differ from that of the Department of Agriculture. Their classes are 3 in number with class 1 including our class 1 and 2 and their class 2 equivalent to our class 3. Class 3 is the equivalent of our class 4 - and at that point USDA cease mapping soils and turns to mapping the resultant topography as a land form ! Deposition will be classified "hummocky or over-blown" in a written note to that effect. We depart from the number of classes of the Department of Agriculture because few of our soils are in cultivation, hence the very swift removal of a soil, characteristic of wind erosion, is not so apparent. Range soils usually suffer from erosion to lesser extent, thus our four wind erosion classes).

Gully Erosion

Gully erosion is essentially an extension of sheet erosion, the runoff water merely concentrates to become an excellent transportation agent for detached soil particles. If the runoff possesses sufficient velocity it will actively cut soil by its own power. Many of the isolated tracts which we classify have gullies crossing the tract which are not part of the management problem within the tract itself. The adjacent land, may, due to a combination of steep slopes and soils concentrate sufficient water to form a very deep gully cutting through the government land. In that case, designate the gully as severe, such as would be the case of a deep gully. Number 3 will be given a sub-letter

"A" as ($3_A$) as to indicate the gully is there not as a part of any of the management or in any way curable by action on the government land.

Class 1 "None to Slight" gully erosion. Gullies are seldom found - if present seldom over a few inches deep and are over 100 feet apart.

Class 2 "Slight to Moderate" gully erosion. Gullies are involved inextricably with sheet erosion. The gullies are small, never over 1 foot deep and never closer than 300 feet.

Class 3 "Moderate to Severe" gully erosion. The gullies are large, deep and either forming an intricate pattern over the surface of the land or are of such size it is impossible to cross with any normal type of conveyance. They are over 100 feet apart.

Class 4 "Very Severe" gully erosion. The gullies have coalesced into an intricate pattern of ridges and valleys, the soil profiles of the entire area have been destroyed and is virtually badlands.

Summary

Recognize that deep gullies, landslides and slips are normal features of many natural landscapes. However, it is possible they may be aggravated by local conditions which have increased geological or started accelerated erosion. Climatic changes initiate new erosion cycles (such cycles have been noted in the United States). Even if it is possible to measure the total loss in inches of soil in one spot, it may not be indicative of erosion loss throughout the area. Record the average for the mapping unit. Erosion is a complex problem. The tendency is usually to over-rate the amount that has occurred.

Table 1. COMPARISONS IN THE THREE CLASSES OF EROSION
Sheet Erosion - Wind Erosion - Gully Erosion

| Physical Factors | Conditions Favoring Erosion | | Conditions Retarding Erosion | |
|---|---|---|---|---|
| | Sheet Erosion | Wind Erosion | Sheet Erosion | Wind Erosion |
| Slope | C, D & E | A & B | A & B | C, D & E |
| Topography | Rough, broken, dissected. | Long, flat or gently undulating slopes | Level, flat, gently undulating plains | Rough, broken, dissected. |
| Soil Texture | Heavy and medium textured clays and silt. | Light soils - sands | Light textured soils - sands. | Heavy and medium textured soils - clays and silts. |
| Soil Structure | Structureless, deflocculated | Structureless , deflocculated. | Well flocculated soils; good granular structure. | Well flocculated soils; good granular structure. |
| Organic Content | Low organic content of the soil. | Low organic content of the soil. | High organic content in the soil. | High organic content in the soil |
| Salinity | Highly alkaline or saline soils | Highly alkaline or saline soils. | Neutral soils, low in alkaline or saline content. | Neutral soils or low in alkaline or saline content. |
| Mechanical Barriers | None present | None present | Stones or gravelly surface, in general a rough texture. | Stones or gravelly surface, in general a rough texture. |
| Vegetative Cover | Barren; open; sparse scattered plants. | Barren, open spaces, sparse scattered or short heavily grazed plants | Forest cover, shrub cover, tall grass cover. | Forest cover, shrub cover, tall grass cover. |
| Climate | Arid - rain falling torrentially | Arid, - cyclic periods of drouth. | Arid - rainfall light not torrential. | Humid or arid, with rare drouth cycles. |


Fig. 5 Land Capability Classes most common on inventoried areas of the basins.

# Section V

## Land Capability Classification

LAND CAPBILITY CLASSIFICATION * - Section V - Field Handbook

Introduction

Land capability classification is limited primarily to agricultural purposes. It is a broad generalization, based on the soil potential and its limitations, for use in management. Fig. 5.

Soils, or lithosols (no soil development) are placed in eight land capability classes. The risk of soil damage or limits for use become progressively greater from Class I to Class VIII. Soils in the classes I, II, III and IV can produce adapted plants and the common cultivated field crops and pasture plants. Soils in classes V, VI and VII are suited to adapted native plants. Some soils in Classes V and VI can produce specialized crops. Soils in Class VIII, severely limited, may produce high economic returns from its recreational and wildlife values.

Bases for Land Capability Classification

1. Vegetative cover is not considered
2. The land capability class is based on the combined effects of climate, permanent soil characteristics, risks of soil damage, limitations in use, productive capacity, and soil management requirements.

   Permanent soil characteristics are; slope, soil texture, soil depth, effects of past erosion, permeability, water-holding capacity, and other similar features.

   Limiting factors such as lack or irrigation water, presence of stones, soluble salts, or hazardous overflow are not permanent limitations IF their removal is within economic possibility.

* Based on instructions on soil and land use capability surveys developed by Soil Conservation Service, May 1958.

3. Each class includes many different kinds of soil. Capability classes I through IV vary by increasing limitations and risks of soil damage for long-time sustained use for cultivation crops.

4. Missouri River Basin Group classification of an area for use is closely related to distance to market, and kinds of roads, these have no place in the criteria for land capability classification.

## CAPABILITY CLASSES
## Detailed Description

### Lands Suited for Cultivation

### Class I

Soils in Class I have few restrictions. They may be used safely for cultivated crops, pasture, range, woodland and wildlife. The soils are nearly level, though some of the rapidly permeable soils may have gentle slopes Erosion hazard (wind or water) is low. Class I soils are deep, productive, generally well-drained and easily worked and suited for intensive cropping. They hold water well and are either fairly well supplied with plant nutrients or are highly responsive to fertilizing for irrigation or dryland farming. Most of our classification is in a climate where dryland farming is marginal. Therefore our Class I will usually be for irrigation. These soils will have permanent irrigation works or be potentially considered for irrigation. Such soils are nearly level, with deep rooting zone, favorable permeability and water-holding capacity. Some may require initial conditioning, including leveling, leaching slight accumulation of soluble salts, or lowering of seasonal water table. Soils will not be placed in Class I if limitations due to salts, water table, overflow or erosions are likely to recur for these are regarded then as permanent natural limitations. Similarly, wet soils or those with slowly or very slowly permeable sub-soils

are not placed in Class I. Some kinds of soils in Class I may be drained as an improvement measure for increased production and ease of productivity.

Class II

Soils in Class II require careful soil management in cultivation, to prevent deterioration or to improve air and water relationships. Limitations are few and management is easy. The soils may be used for cultivated crops, pasture, range, woodland, or wildlife food and cover.

Limitations of soils in Class II include: one or more of the following (1) gentle slopes, (2) moderate susceptibility to wind or water erosion, (or moderate adverse effects of past erosion) (3)less than ideal soil depth, (4) somewhat unfavorable soil structure and workability, (5) slight to moderate salinity or alkali, easily corrected, but likely to recur, (6) occasional damaging overflow, (7) wetness correctable by drainage but existing permanently as a moderate limitation, and (8) slight climatic conditions placing limitations on soil use or management.

Again, in our field work, most of these soils will be irrigable either with works anticipated or already in use. Examples of variation within soils slopes might go from 0-8% on some silt loams, whereas the clay loams may run 0-1%. Slight to moderate erosion will be probable.

Class III

Soils in Class III have more restrictions than Class II, and when used for cultivated crops the management practices are usually more difficult to apply and to maintain. Class III soils may be used for cultivated crops, pasture, woodland, range, or wildlife food and cover.

Limitations of soils in Class III restrict the amount of clean cultivation, time of planting, tillage and harvesting, choice of crops,

or a combination of these items. Limitations may result from the effects of one or more of the following: (1) moderately steep slopes, (2) high susceptibility to water or wind erosion, (3) frequent overflow accompanied by some crop damage, (4) very slow permability of the sub-soil, (5) wetness or some continuing waterlogging after drainage, (6) shallow depth to bedrock, hardpan, or claypan that limits rooting zone and water storage, (7) low moisture- holding capacity, (8) low fertility not easily corrected, (9) moderate salinity or alkali, or (10) moderate climatic limitation.

When cultivated, many of the wet, slowly permeable but nearly level soils in Class III require a drainage system and a cropping system that maintains or improves structure and tilth of the soil. To prevent puddling and to improve permeability, it may be necessary to supply organic matter to such soils and avoid working them when they are wet.

In irrigated areas, the soils in Class III have limited use because of high water table, slow permeability, and the hazard of salt or alkali accumulation. Each distinctive soil in Class III has one or more alternative combinations of use and practices required for continued use, but the number of practical alternatives for the average farmer is less than for the soils in Class II. We will normally, of course, encounter Class III only in the irrigated districts, or in our case, those lands susceptible to irrigation, as in Desert Land Entries.

Class IV

The restrictions in use for Class IV soils are greater than those in Class III and the choice of plants is more limited. When these soils are cultivated more careful management is required. They may be used for crops, pasture, woodland, range or wildlife food and cover.

Soils in Class IV may be well suited to only two or three of the common crops, or the amount of harvest produced may be low in relation to inputs over a long period of time. Use for cultivated crops is limited as the result of the effects of one or more permanent features, such as (1) steep slopes, (2) severe susceptibility to water or wind erosion, (3) severe effects of past erosion, (4) shallow soils, (5) low moisture-holding capacity,(6) frequent overflows accompanied by severe crop damage, (7) excessive wetness with continuing hazard of waterlogging after drainage, (8) severe salinity or alkali, or (9) moderately adverse climate. Often poorly drained, nearly level soils placed in Class IV are not subject to erosion, but the heavy soil is poorly suited to cropping because of the time required for the soil to dry out in the spring, coupled with low productivity. Some soils in Class IV are well suited to one or more of the specialized crops.

In sub-humid or semi-arid regions ( which characterizes our area of operations)soils in Class IV produce good yields of adapted cultivated crops during years of above-average rainfall; low yields during years of average rainfall; and failures during the years of below- average rainfall. This is true especially on those lands suitable for dry-land farming, which require intensive practices. During the low rainfall years such land must be protected, even though there can be little or no expectancy of a marketable crop. Special treatments and practices to prevent soil blowing, conserve moisture, and maintain soil productivity are required. Sometimes crops must be planted or emergency tillage used for the primary purpose of maintaining the soil during the years of low rainfall.

## Soils Maintained in Permanent Cover
## Lands Unsuited to Cultivation

### Class V

Soils in Class V have limitations that restrict the kinds of plants that can be grown and that prevent normal tillage of cultivated crops. They are nearly level, some are wet ( are frequently overflowed by streams), are stony, have climatic limitations, or have some combination of these limitations. Examples of Class V are (1) soils of the bottom lands subject to frequent overflow that prevents the normal production of cultivated crops, (2) level or nearly level stony or rocky soils, and (3) ponded areas where drainage for cultivated crios is not feasible but where soils are suitable for grasses or trees. Because of these limitations cultivation of the common crops is not feasible, but pastures can be improved and benefits from proper management can be expected. Range sites typical of Class V are: Wetlands, Subirrigated, and Overflow.

### Class VI

Soils classed in Class VI are suitable for range or pasture. Improvements if needed, are those such as seeding, fertilizing, water control and contour furrows or water spreaders. Soils in Class VI have continuing limitations that cannot be corrected, such as (1) steep slopes, (2) severe erosion hazards, (3) effects of past erosion, (4) stoniness, (5) shallow rooting zone, (6) excessive wetness or overflow, (7) low moisture capacity, (8) salinity or alkali, or (9) severe climate. These soils are not generally suited for cultivated crops, but they may be used for pasture, range, woodland, or wildlife cover, or some combinations of these.

The soils in Class VI will include Range Sites; Sandy, Silty, Clayey - in general those range sites which have not been reduced in

carrying capacity due to limitations.

Class VII

Soils in Class VII have very severe limitations that make them unsuited for cultivation but restrict their use largely to grazing, woodland, or wildlife. Physical conditions of soils in Class VII are such that it is often impractical to apply range or pasture improvements such as fertilizing, water control measures like contour furrows or water spreaders. However, the Bureau works with these measures on Class VII soils for noxious weed control, flood control etc. The restrictions are more severe than in Class VI because of one or more continuing limitations that cannot be corrected, such as (1) very steep slopes, (2) erosion, (3) shallow soils, (4) stones, (5) wet soil, (6) alkali, (7) unfavorable climate or other limitations. They can be used safely for grazing or woodland, food or cover or some combination of these, under proper management. Soils in this class are normally those which in some way have had restrictions placed on them, lowering their carrying capacity below that imposed by climatic conditions.

Range Sites typical of Class VII are Shallow, Very Shallow, Saline Upland, Thin Breaks.

Class VIII

Soils are land forms in Class VIII and have limitations that preclude their use for commercial production and restrict their use to recreation, wildlife, water supply, or aesthetic purposes.

Soils and land forms in Class VIII cannot be expected to return benefits from management of crops, grasses, or trees, although benefits from wildlife use, watershed protection, or recreation are possible or may secure the greatest economic returns.

Limitations that cannot be corrected may result from the effects of one or more of the following: (1) erosion or erosion hazard, (2) severe climate, (3) wet soil, (4) stone, (5) low moisture capacity, and (6) salinity or alkali.

Badlands, rock outcrops, sandy beaches, river wash, mine tailings, swamps, marshes, playas and intermittent lakes, barren mountains and talus slopes are included in Class VIII. It may be necessary to manage plant growth and soils, or land forms, in Class VIII in order to protect other more valuable soils, to control water, or for wildlife or aesthetic purposes. Range Sites typical of Class VIII are Badlands, Shale, Saline Lowland.

## SUGGESTIONS FOR PLACING SOILS IN CAPABILITY CLASSES

The basis for capability classes are the soils characteristics and climatic limitations in relation to use, management, and productivity.

### Climate and Capability Classes

Under conditions of the Missouri River Basin Group field classification climatic limitations are usually overriding. The most important limitation is lack of rainfall in the arid and semi-arid portions of the basin. The extremely low temperatures and short-growing seasons in the higher elevations are also of importance. In a borderline decision soils in a semi-arid portion of the basin, sandy soils with favorable plant-water relationships,may go one class towards a higher land use capability. The capability of comparable soils, of course, will decrease with the decrease in effective rainfall. (Thornwaites "Precipitation Effectiveness" can be a broad guide -

precipitation effectiveness is greater than 44, consider Class I; between 44 and 31, consider Class II; between 31 and 25 - Class III; between 25 and 19 - Class IV; and below 19 - Class V, VI or VII.) In semi-arid or sub-humid climate, typical of most of our activities, Class II, III or IV are only possible if the moisture limitation is removed by irrigation. In semi-arid areas Class IV can be used for dryland farming.

Bottom Lands and Capability Classes.

Excessive moisture is not commonly a problem with our area. Some areas of bottom land can be classified on higher classes with control of over-flow by the construction of dikes. Much of this over-flow land, in the sub-basins, will be confined to perennial hay production because of climatic restrictions.

Irrigation and Capability Classes.

Where there is a possibility of irrigation (feasible or already practiced) the presence of soluble salts or exchangeable sodium in toxic amounts can be seriously limiting. The guides following for land capability classes are to be used for irrigated lands or those capable of being irrigated.

Class II - Slight salinity or alkaline limitation - crops are slightly affected. In irrigated areas, even after salt removal, slight salinity or alkali is still present or is likely to recur.

Class III - Moderate salinity or alkaline limitation - crops are moderately affected. In irrigated areas, even after salt removal, moderate salinity or alkali is still present or is likely to recur.

Class IV to VI - Severe salinity or alkali limitation - crops are seriously affected on cultivated land. Salt tolerant plants usually

are found on non-cultivated land. In irrigated areas, even after leaching, severe salinity or alkali is still present or is likely to recur. Plants indicative of this condition would be saltgrass, greasewood, gardner saltbush.

Class VII - Very severe salinity or alkali limitation - satisfactory growth of useful vegetation is impossible except for some of the most salt tolerant forms of plant life.

Erosion and Capability Classes.

Determination of land capability class on erosion hazard is dependent on several factors. Not only the steepness of the slope, but also the length and shape of the slope will influence soil and water factors. These will have to be used as guides, plus the already existing erosion on the land, as a basis for classification of some of the more favorable soil sites. In the Missouri River Basin much of the soil is susceptible to wind erosion. Therefore, consideration as to slope alone is not indicative,as a consideration of wind erosion hazard must be taken into land capability classification also.

Soil Depth and Capability Classes.

Soil depth is very often important in classification of soils. In some soils the C horizon will be included, and in other ones only an A horizon. The soil depth is described in the section under Soils, but if the C or underlying material is to be penetrated by plant roots, it would obviously be effective soil depth. In general irrigated soils in Class I are 60 inches or more in depth.

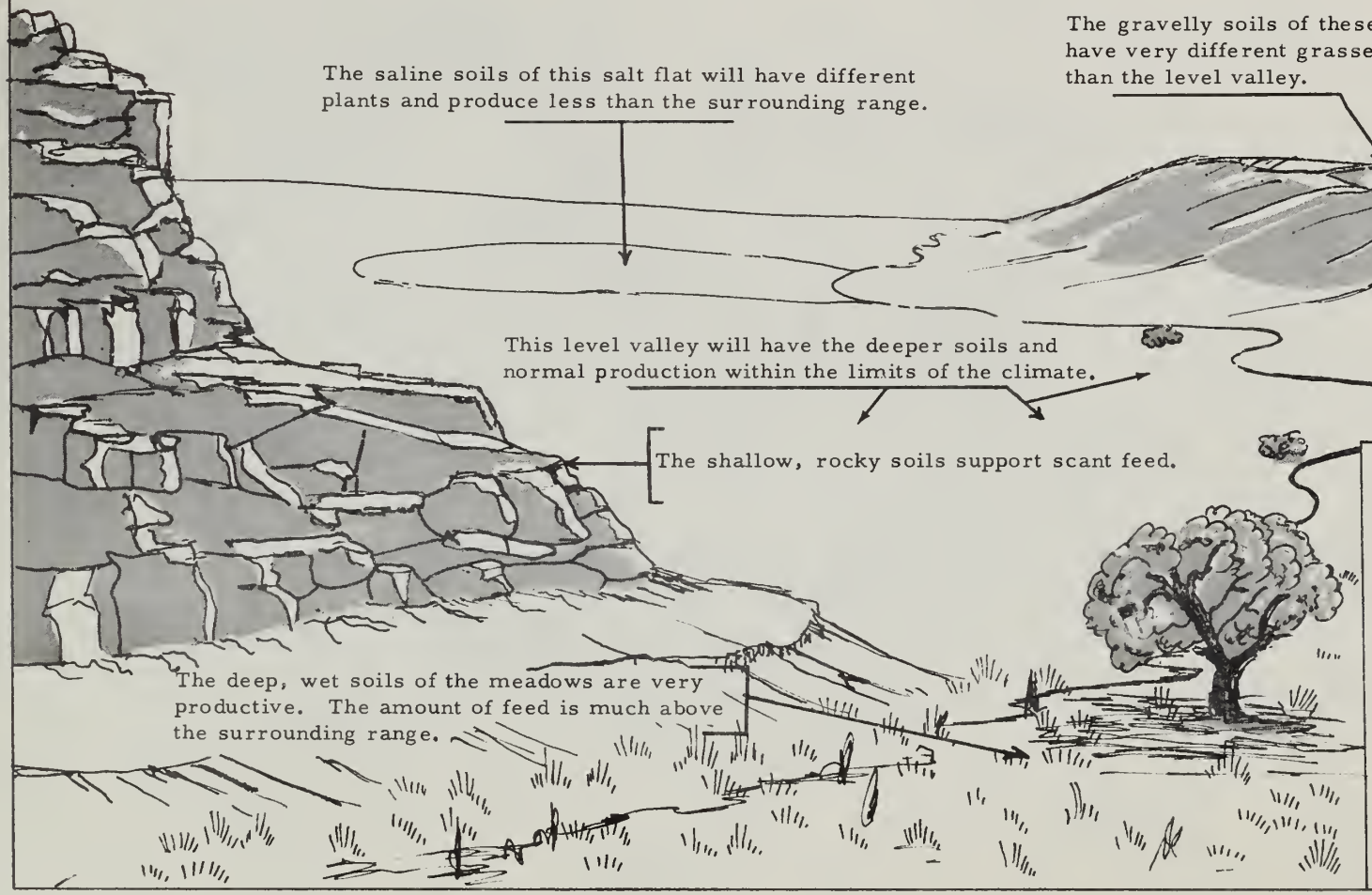
# Section VI

## Range Inventory

## Condition, Carrying Capacity, Indicators

**Figure 6**

Each part of the range has its own soils, topography, minerals, plants, and climate. Each part will produce different feeds, and these will vary in amount. We recognize and map each separately as range sites. For example:




**Step One**

We check soils, slope, salinity, to see why each site varies in potential.

Range Inventory - Section VI - Field Handbook

The Missouri River Basin Group is charged with inventory of the public land reserve. These lands in native vegetation but not forested can be categoried by many kinds of range inventory techniques. For this, however, the Missouri River Basin Group uses the Ecological Site method of survey. This system was adopted because it gives the potential capability of the different kinds of rangeland in terms of quantity and kind of forage, and appraises the present condition of this range relative to those potentials.

Range, for our survey, is defined as land on which the original (potential) plant community is composed principally of native grasses, broadleafed plants and shrubs. This embraces those lands with uneconomic grazing values, such as desert, badlands, and other naturally barren and semi-barren lands as well as the productive ranges. However, the ecological system of range inventory does not fit where the original plant community is forest. Accordingly timbered lands are not evaluated, whereas savannah lands are. Aspen stands, although precursors to forest, have forage value and are evaluated by a special guide ( at the end of the next section)

## Range Sites

### Range Site Concept

The range site concept is fundamental to our survey.

Range varies in its productive capacity. Mountains and valleys, saline soils and unstable sands are part and parcel of the range - each produces according to its capability ( Fig. 6 ).

These differences in productivity are the framework of the survey - the range site. The range site is a specific area with boundaries we can locate and whose characteristics we can describe. Within the complex of the range site environmental factors vary but operate for general uniformity. Each site has its own set of uniform factors which characterize it - and no other range site.

Unique and characteristic of each range site, is its own original (or potential) plant community. This distinctive community is formed by the relatively uniform environment throughout the range site. Unless it is materially altered the range site will maintain its characteristic potential plant community. The microenvironment of the range site varies throughout and accordingly the relative composition of any natural plant community cannot be expressed exactly instead is given as the native plant community, characteristic groupings of plant species expressed in increments of 5%.

Composition of Original Vegetation.

The original (or potential) plant community for a range site is determined by:

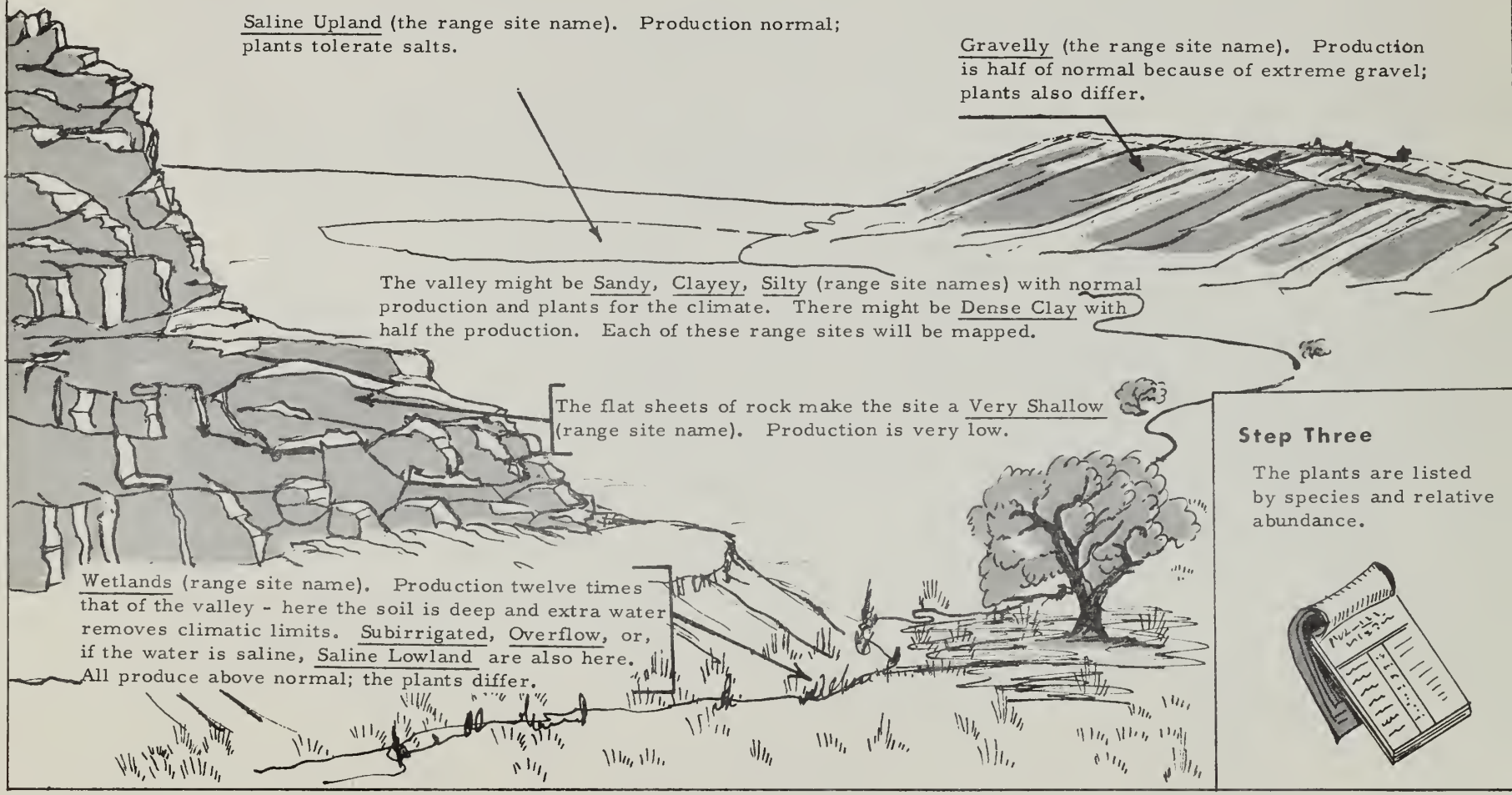
1. Evaluating the relict vegetation on protected or relatively undisturbed areas, graveyards, meaas, etc.
2. Evaluating grazed areas with known records of past use.
3. Findings in research in ecological and soils literature.
4. Searching historical records narrative and early photographs.

The evidence from no one of these sources, in itself, is likely to be conclusive. Check your evidence. Assure yourself that on the relict area you use for a guide abnormal conditions such as drought, erosion, repeated fire, snow or water concentration have not distorted

**Figure 7**

**Step Two**

Each range site is a unique environment with definite potentials. Each range site differs from all others by one of two characteristics - the amount of feed produced is different, or the kind of plants that grow there is different. Range sites have names that describe them, such as: Silty, Shale, Badlands, Thin Breaks, Very Shallow, Sands, etc.




**Step Three**

The plants are listed by species and relative abundance.

the picture. Disturbance is normal to all sites, however, we assume the plant community found on range with the least disturbance will best represent the potential for the site. Sometimes, especially in arid climates, these communities are not as good as you expected. One relict area in Idaho is so poor it was named "The Sheep Bedground". If a relict community does not agree with your preconceived ideas - re-examine all your evidence and perhaps change your mind!

Permanence of the Range Site.

Range sites are permanent. They may have their characteristic plant communities modified or even destroyed but it will re-establish. Action modifying a plant community could be drought, grazing, fire, fertilization, brush removal and even short term tillage. The effect of these influences is temporary and the range site is not permanently affected.

If, however, these same influences are so drastic and prolonged that severe erosion, or an increase in salinity, or reduction in fertility or lowering of the water table alter the productive capacity from the original range site - then a new range site consistent with its altered potential is described

Range Site.

You will distinguish between range sites only if there are differences in the kind of plants that compose the original plant cover or differences in the amount of forage produced. Fig.7 Step Two. These differences in the kind or quantity of forage must be great enough to require changes in range management, such as a different stocking rate.

(Do not distinguish between range sites merely because of a difference in soils or climate). To limit range site numbers they must be encountered sufficiently often in such size and frequency as to materially affect range management in large acreages. They must be held to a minimum number.

Variations in yield that require distinguishing an additional range site will change with the kind of rangeland. On wet meadows a difference in yield of 100 pounds of air-dry herbage per acre is not considered in the same light as 100 pounds on a desert range site that produces a total of but 200 to 300 pounds per acre. The deciding factor is - will the difference in yields affect management ?

Avoid site differentiation on the basis of a single factor of environment, or a combination of factors, unless the effect from one or all shows in significant variations in composition or yield.

Recognizing the Range Site

Single factors of the environment can divide one range site from another, for example, the presence, or absence of a water table within the root zone, or highly saline soils in contrast to non-saline soils. Soil Texture, Soil depth, or topographic position may distinguish between range sites as between sand dunes and heavy clays, deep soils in opposition to very shallow soils, or uplands compared to overflow bottom lands.

Distinction between range sites grows more difficult on rangeland with similar soils, relatively uniform topography and a gradual change in climate. Then changes in composition and production are gradual - but cumulative. These differences usually show up first in changes in yield, secondly in changes in composition.

Any single factor of the environment must depend for its effect on all the other conditions of the habitat. For example, deep soil on a bottomland site, with extra moisture from repeated overflows gives greater yields than would the same depth of soil on sloping upland. Two extra inches added to the annual rainfall will be of extreme importance to an arid desert range but of minor significance to the higher rainfall on the surrounding mountains. The total environment determines the range site.

Range Sites and Precipitation Zones

Range areas with similar soils and topography may have different potential plant communities because of climatic differences. The average annual precipitation of the "Clayey" range sites of the Missouri River Basin ranges from 5" to 35". There are great differences in forage production between these extremes. Range sites are also distinguished, one from the other, by writing the precipitation zone with the sites, i.e. Clayey 5"-9"; Clayey 10"-14", on the guides. The writeup page will have the rainfall zone indicated, the maps and aerial photographs will show this division with its proper symbol indicating the zone.

Naming Range Sites

Range sites are named. Site names should be brief and based on readily recognized permanent physical features, such as the kind of soil, climate, topography, or combinations of these features. Permanent physiographic features and the life-form (not species) of vegetation characteristic of the site are sometimes used.

Typical examples of such range site names include - Sands, Badlands, Saline Lowlands, Pan-spots, Gravelly and Savannah.

Mapping the Site ( Also see Boundaries)

Range sites vary in size. Boundaries drawn on a map may include (1) a single range site, (2) a dominant range site with inclusions of other sites, and (3) a mixture of two or more range sites of relative equal size that are impractical to separate.

Where a single range site or a site with less than 20 percent inclusion of other sites is outlined, the symbol of the dominant range site is shown on the map. The minor site is discussed together with the dominant site in the appropriate notes. Where an association of sites is mapped within one site boundary line, the symbol of each site is indicated, e.g. dense clays, sands as DC-Sa. The writeup book, however, will give the relative percent of each as DC 65%, Sa 35%.

The minimum area to be "cut-out" varies with mapping scale, relative productivity of the site, grazing use patterns and the size of the rangeland.

The natural tendency is for the examiner to map in more detail than is necessary both on large-scale maps and on small isolated tracts. An isolated tract of public domain is in a different frame of reference than the same rangeland in an entire township; greater detail is expected. As a guide - one hundred sixty acres on area classification, forty acres on isolated tract classification is usually the smallest acreage to be mapped - unless a meadow (example of exceptionally high yield) is involved. "Stringers" of meadows which are shown on 2" - 1 mile maps (for District use) are dropped out of $\frac{1}{2}$" - 1 mile maps (for reports).

Range sites capable of producing exceptionally high or exceptionally low yields are normally mapped in more detail when they occur within sites of medium productivity. The examiner must vary his mapping technieque by need. Avoid excessive ( and often) misleading detail. Ask yourself -

are these site boundaries significant to the proper use and management of the public land reserve? The more important the boundary - the smaller the minimum area !

The boundaries of range sites are shown on a field map by solid red, inked lines. The symbols of the range sites are shown directly within the areas delineated along with remainder of formula. Symbols, abbreviations and legends are established in this manual in other sections.

Range Condition

Range condition is a statement which compares the present vegetation to the potential for the site. If a particular range is described as being in "Good Condition" or "Poor Condition" that description is always relative to a standard that has been established for that range site* This standard is the kind and amount of vegetation the site can produce.

* The Bureau uses Range condition in a different sense (see Volume IX of the Bureau Manual on Deming two-phase method). On normal sites the ratings are similar but on "badlands",for example, although the soils are producing at top capacity and ecologically are in "climax" condition, Deming system places them in "Poor" because of scant ground cover and scarcity of livestock forage. The Parker "three-step" is used for permanent studies by the Bureau.

Accordingly, range condition represents the degree to which the plant composition ( an ocular estimate to the nearest 5% of annual growth, by weight, of the species ** comprising the plant community) departs from that of the native potential plant community. On this basis there are four range condition classes.

| Condition Class | Percent of Present Composition that is Potential for the Site |
|---|---|
| Excellent | 75-100 |
| Good | 50-75 |
| Fair | 25-50 |
| Poor | 0-25 |

Determining Range Condition

We find range condition by comparing a site with its vegetation to the relative abundance of these same species of the sites potential plant community. To do this we segregate the plants by their response to grazing use on specific range sites into three categories: Decreaser. Increaser and Invader plants.

Decreaser Plants are those of the potential plant community that dwindle in relative abundance with continued moderately-heavy to heavy grazing use, drouth, wrong season of use, wrong class of livestock, poor

** This includes all photosynthetic surfaces. Prickly pear, for example, will have succulent stems (pads) many years old which compete for light and water. Brush, on the other hand, would have only annual growth of new twigs and leaves.

**Figure 8**

**Step Four**

Each range site is unique. Therefore, each site will have different plants or produce different amounts of those plants.

We say each site has a potential plant community. This is the original plant cover that develops on the site.

Plant communities change constantly - yet they are inherently stable because they will always return to a balance with the environment (with the removal of a disturbing effect).

We use the stability of the potential plant community for a vegetative benchmark. It is like a balloon - ever changing, but anchored to one spot (the range site), it always returns.

Each range site (refer to Step Two) has its unique original plant community as its vegetative benchmark. Each segment of range is measured from this benchmark as to Excellent (within 25% of this benchmark); Good (within 50% of this benchmark); Fair (within 75% of this benchmark); Poor (departure over 75%).

Influences on the plant cover include annual weather and climatic cycles; over use or under use; too early use or late seasonal use; class of livestock, fire, cultivation, erosion, or combinations.

water distribution, topography, etc. They are perennials usually palatable to livestock and are often, although not always, dominant species of the potential plant community. The total of all these is tallied in determining the range condition class.

Increaser Plants are those of the original plant community that occupy more space,hence increase as the decreaser plants drop out. Plants that increased at first may drop out later with continued pressure. Increaser plants are often, although not always, the shorter, less productive, sub-dominant member of the original vegetation. Their forage value varies from high to low. Low-value plants naturally tend to increase faster than high-value plants under grazing. Increaser plants are handled by the percentages in which they normally occured in the original plant community. Their present abundance up to, but not exceeding, this maximum is added to the total already derived from all of the decreasers. This total gives a numerical rating or range condition in one of the four classes, 0-25% Poor, 25-50% Fair, 50-75% Good, 75-100% Excellent. (Fig. 8.)

Invader Plants are those plants not part of the potential plant community for the site. They are not restricted to exotics, however, as they may be normal to the potential plant community on other range sites nearby. Invaders include woody plants, herbaceous perennials, and annuals. No invader is "counted" in determining the range condition class.(Special treatment of Annuals follows the section on feed calculations).

A work-sheet which permits comparison of the existing vegetation with the potential and computation of the range condition class for a specific range site, is illustrated in Figure 9.

Guides for determining range condition are prepared for each site.

Range Site & Condition Write-up
(Ecological Site Method)

Date_____

Plot No._____Examiner_____

T_____R_____Sec_____P.M._____

_____

| Present Composition | | Climax |
|---|---|---|
| Species | % | % Usable |
| Plants are listed by symbol (See Sec IX - Plant List) as they are encountered. Relative abundance is estimated by increments of 5%. | Relative abundance by percent. | Percentage of each plant species as it would be encountered in the original vegetation (See Guide Appendix A) |
| Total | 100% | % Condition |

GPO 840381

_____AUM's/Acre

Figure 9. Field Writeup Sheet

(See Appendix A.) The significant decreaser and increaser species are given. Supplemental lists can be prepared of decreaser, increaser and invader species that occur on the various sites but for reason of economy of space are not included in the guide.

Carrying Capacities.

The most reliable basis for the development of stocking rates for use with the ecological site system is a combination of actual use records of individual range sites, with an evaluation of the range trend. If possible records should extend over a period of years that include season of high, low and near-average forage production.

Stocking rates by range sites and condition classes are intended as a guide to the intensity of grazing that will result in maintenance or improvement of the forage resources, the figures are conservative. Seasonal and annual variations in forage production require timely adjustments in stocking rates for proper range use. Appendix A are samples of Guides from which the stocking rate is calculated.

Example. Range condition is Good 65% - turn over the Technicians Guide to Range Sites, Condition Classes, determine the proper precipitation zone (certain range sites use the zone where the site is located, others use higher or lower zone depending on the range site limitations. These sites with proper zone for their use are given on the face of the guide.) Our location is in 10" - 14" annual precipitation zone and the site is sandy. We use the 10" - 14" zone from the instructions on the face of the guide. Drop down Range Condition colum to 65% go right to 10" - 14" precipitation zone. The amount of AUM's per acre is shown as .26 for condition of 65% in 10" - 14". Because the Bureau uses Surface acres per Animal Unit Month, the .26 is directly

converted by the table on the right from AUM's per acre to acres per AUM by .26 equals 3.8 acres per animal unit month.

Were the range site to have been sub-irrigated meadow the instructions on the face are to double 20" - 24" precipitation zone values, thus 65% would give .52 x 2 = 1.04 AUM's per acre (even though the meadow is actually in 10" - 14" precipitation zone, or 1.0 acres per AUM which would reflect the extra value of the wet meadow).

Departure from Carrying Capacity - Percentage Cuts:

Under certain circumstances it is necessary to limit the stocking of livestock below that indicated in any Range Condition Guide. This would be expressed as a reduction by percentage i.e. 5%, 10%, etc. The major premises for such a cut are as follows:

A. Non-productive acreage included in site:

Non-productive areas too small to "type out" may, in the aggregate, materially reduce the surface acreage which can produce forage. Examples of this situation are small patches of dense timber, barren ridges of rock, or sterile salty basins.

B. Unavailable Feed:

Forage may be limited by availability. Dense timber, excessively steep slopes or exceedingly rocky conditions will exclude livestock or limit their use of forage on certain types. However, if this feed is available to wildlife be certain to note this.

C. Damage to the area:

A common reason for reducing grazing is to avoid damage to the range. For example, an area with unstable soils which cannot be stocked to the quantity of forage present because grazing may increase erosion to dangerous proportions.

D. Livestock Health:

The presence of poisonous plants in large quantities or on large areas may result in livestock losses if the range is fully utilized.

E. Competitive Use:

Wildlife, such as big game or rodent concentrations, may necessitate adjustment of the carrying capacity downward to care for the additional pressure on the range.

F. Lack of Livestock Water:

This may not be important even though no water is present, as winter sheep-use on desert range where snow supplies the water. Also wells may open the area to stock. Because this water lack may be solved, be certain that your reduction is easily recognized so full carrying capacity can be calculated, when provision for livestock water is made later.

At all times when a percentage cut is given, state the reason in your notes for doing so. For example: "This area is characterized by unstable soils which reduce the stocking rate below that of the Guide by 15%".

Be cautious on cuts, a cut cannot be arbitrary but based on all considerations. If any doubt exists on the validity of a reduction - do not use it - the doubt is sufficient grounds to reject it.

Annuals

With the resumption of normal or above normal precipitation - following periods of drought - annual weeds and grasses occur in exceptional abundance on ranges, regardless of range condition. For example, in the Fort Worth Grand Prairie in Texas, normal production

per acre of one range in Good condition is 3,500 pounds; in 1957 its production of annuals alone was 12,500 pounds. Another example - a short grass prairie in Kansas in "Fair" condition, with a normal production of 1,600 pounds, produced 15,000 pounds of sunflower in one "wet year". If instructions on the ecological site method of range inventory of the Missouri River Basin Group were followed regarding relative percentages of plant production by weight, this would have dropped both pastures, respectively, from a Good or Fair condition to a Poor condition, with a consequent lowering of carrying capacity.

The sporadic resurgence of annuals, necessitates special treatment in range condition calculations in those wet years. Therefore, annuals will be listed on the field writeup, but the percentage if it exceeds 10 percent will be circled in red and listed as 10 percent. The remaining vegetation in composition estimates will add to ninety percent. If, however, precipitation is normal in the area, and instructions of the crew chief may be to include annuals, this will provide for the normal amount of annuals on abused ranges where these short-lived plants occur because of range conditions - not because of abnormal weather.

Use of Range Site and Relative Condition.

One use of the range site is to identify those areas of rangeland with different capabilities for forage production, regardless of what they are now producing. Range sites produce different kinds of range plants and different quantities of forage. Such identification pinpoints those areas with the greatest production potentials.

An appraisal of the condition of the range within each site indicates to the range manageer those areas producing below their potential. Condition classes within each site produce different kinds and quantities of forage. Usually, but not always, a lower condition

means lesser amounts of less valuable forage. When we relate these classes to the potential production for the site, we provide the manager with a valuable clue to those areas where we predict the greatest response to improvement programs.

The range manager, knowing what the public domain can be made to produce, both in terms of quality and quantity of forage, is then in a position to determine whether the measure necessary for improvement is worth the cost. The record of the range condition within each site has the further advantage of providing a "benchmark" against which future improvement or deterioration can be checked to indicate as to whether the planned management is achieving the desired results.

In summary, different range sites and the condition classes within them produce different kinds of plants, which vary in their seasonal development and quantity of forage. Recording this will give a basis for decisions on stocking rates, season of use, systems of management, or other conservation practices needed to maintain or improve the range.

Range Indicators for Narrative Comment

As part of the Missouri River Basin Group report we should, if possible, comment on the appearance of the range. Permanent transects and the two-phase system are used by the districts at 5-year intervals for determining trend. The guide following will be used for our inventories as an on-the-spot notes summarizing vegetation and soils.

Plant Vigor

Plant vigor can be seen in the size of the plant, and its production considering its age and its environment. A young plant is more vigorous than an older plant. Grasses that form bunches or tufts often assume a sod-form when their vigor is reduced. A weak plant produces small rhizomes and stolons if spread is vegetative.

Two pastures separated by a fence may have the same range condition, yet one presents a more favorable appearance than the other. To judge a situation such as this, keep in mind that many of the grasses with an upright habit of growth will, under heavy grazing, maintain almost the same ground cover but grow low to the ground with the leaves on the side extending out low and parallel to the ground, almost as though the plant were stoloniferous. This is a growth form sometimes called "escaping grazing". At times the composition may be maintained by this "escaping" habit of growth yet your visual inspection will instantly reveal the difference between the two pastures. Thus, in those pastures where you have a doubt as to the accuracy of the guide refer to the habit of growth of the grass itself.

Don't assume that an apparent lack of vigor is always due to grazing management, especially on range sites with obvious limitations

for plant growth. Remember drouth, or excessive rain, have opposite but exceptional influences on vigor of all the vegetation. Vigorous plants with higher grazing preference, however, would indicate improved range conditions.

Abundance of Seedlings and Young Plants.

A plant community is maintained by continuous reproduction of the individual plants. Effective reproduction is shown by young seedlings, the presence of plants of various ages, and spread by tillers, rhizomes, and stolons. Such reproduction varies with the individual species and with surrent growing conditions. Except in unfavorable growing season, for example, vigorous reproduction by plants with a high grazing preference is evidence of improving range. However, few seedlings are able to establish themselves on range in excellent condition.

Generally invasion of plants, not native to the site, means a decline in the range. Such plants, however, may flourish on disturbed areas when the site is in otherwise good condition. Some invaders, particularly annuals, may temporarily preempt any site in favorable years. This marked increase in annuals and short-lived perennials is often true in wet years or abnormally wet seasons following drouth. ( See "Annuals" in Range Condition Section).

Plant Residue

Plant residue accumulates from production of the plant community minus that removed by grazing, haying, fire, wind or water. The mulch formed by this accumulation is an important addition to the soil. Deserts, however, have little mulch produced, nor do specific Range

Sites, such as Shales and Badlands. Excessive grazing use, below normal herbage production, because of drouth or recent fires, and abnormal loss of plant residue resulting from transportation by wind or water, may result in levels of plant residue accumulation below those considered reasonable for the site. On the other hand, with few exceptions, several years of plant residue does show improving range.

Conditions of the Soil Surface.

Unfavorable conditions on the soil surface have drastic effects on the rate of range recovery. Lack of plant residue permits splash erosion and crusting of the soil surface. This slows water intake, hinders seedling establishment and vegetative propagation, and means high surface temperatures with less survival of seedlings. These conditions in turn increase the rate of water runoff and soil loss, reduce effective soil moisture - and for most soils result in unfavorable plant, soil and water relationships. However, certain Range Sites, Shale, Badlands, Saline Uplands, etc., are characterized permanently by such conditions. Evidence of an increase in bare ground, soil crusting, compaction from trampling, plant hummocking and erosion in certain range sites are favorable signs on which to comment.

Ground Cover

The condition of soil surface is inseperable from the actual amount of plants covering the ground. Comparison of this amount of ground covered by the perennial plants to the total area is expressed as density. An increase or decrease in amount of ground covered, in itself, is not determinate. For example, mid-grass and even tall-grass

communities can deteriorate to short-grass. Short-grasses can, and often do, increase the area covered by plants - thus, despite the fact the range is going downhill, density of ground cover may have increased. If the general relative life-form, mid-grass for example, is preserved throughout the community density is a more reliable indicator of range improvement. High density is so often associated with plants that escape grazing pressure, as do the short-grasses, that it must be interpreted relative to the climate, to the specific range site, and especially to the original (potential) plant community.

Summary of General Range Observations.

Vigor, seedlings, residues, and soils vary in relative importance according to the specific range site. A single factor in itself will not be conclusive. All must be weighed in their proper relation to each other and the range site. Then their sums substantiated by your observations should, if it characterizes large areas, be incorporated into the individual range site notes and on isolated tract reports.

# Section VII

## Range Sites

## Carrying Capacities, Special Tables (Aspen)

Range Site Criteria - Section VII - Field Handbook

Only natural grazing lands to be used as native pasture or native meadow will be classified as range sites. In order to fully designate a type of range site a soil-group name is combined with designation of the precipitation zone and limits of latitude and longitude, as indicated by a state or geographic part of a state; for example, Clayey 10-14" p.z. Glaciated Plains, Montana. On maps within the work unit, only the range soil-group name is necessary unless more than one p.z. occurs locally. Legends on range photos and other widely distributed materials should carry the full designation of site.

The following range soil-groups are listed in presumed order of natural productivity, considering total airdry weight of all herbage produced through the entire year.

I. Soil-groups that can produce more herbage than ordinary range uplands because of plainly superior soil moisture availability. (The "Postclimax" areas of Clements)

WL - WET LAND: Marshy lands with subirrigation where seepage, ponding etc. raises water table to above the surface during only a part of the growing season. Too wet for cultivated crops but too dry for common reed, cattails, or true aquatics.

Sb - SUBIRRIGATED: Lands with water table rarely above the surface during the growing season but subirrigated most of the growing season.

SS - SALINE SUBIRRIGATED: Subirrigated land where salt and/or alkaline accumulations are apparent and halophytes occur over a major part of the area.

Ov - OVERFLOW: Areas regularly receiving more than normal soil moisture because of run-in from higher land; including stream overflow, run-in

from higher slopes, and areas with water spreading systems. (Not Subirrigated or Wet Land.)

SO - SALINE OVERFLOW: Areas regularly receiving more than normal soil moisture because of run-in, where salt and/or alkali accumulations are apparent and halophytes occur over a major part of the area.

Sa - SANDS: Deep, loose, fine sands and very fine sands on nearly level to undulating (rolling) relief; excepting compact dark nearly level loamy fine sands and loamy very fine sands. (Not loose medium and coarse sands.)

Sv - SAVANNAH SITES: Uplands on which grass cover with isolated trees is normal (climax). Do not confound with savannah type of cover resulting from overgrazing of natural grassland or cutting of natural forest land. This site is common at margins of forest climates and in grassland climates where soil moisture relations especially favor tree growth. Bedrock at the surface usually indicates a Very Shallow site. (For details see "The Savannah Concept and its Use" -- Ecology 38:442. 1957.)

II. Ordinary (normal) upland soils with gentle relief and no obvious soil inhibitory factors. The vegetation can make a normal response to climate reflecting regional climax.

Sy - SANDY: All normal coarse to fine sandy loams (not true sands) plus dark nearly level loamy fine sands, and loamy very fine sands; excepting relatively impervious (cemented) kinds which are better classed as Thin Sandy, or a type of Shallow or Very Shallow.

Si - SILTY: All normal very fine sandy loams, loams, silt loams and silts.

Cy - CLAYEY: All normal relatively pervious sandy to silty clay loams

and clays - normally granular.

III. Uplands with soil factors that prevent development of the regional climax. (The"Preclimax" areas of Clements.)

TSy - THIN SANDY: Thin but deep sandy soils - not true sands - usually of hills with smooth surfaced slopes generally over 20 percent but also of lesser slopes where cementing occurs in upper layers on drying.

TSi - THIN SILTY: Thin but deep silty soils of hills with smooth surfaced slopes generally over 15 percent.

TCy - THIN CLAYEY: Thin but deep clayey soils of hills with smooth surfaced slopes generally over 15 percent.

SwC - SHALLOW CLAY: Shallow normally granular clays of hills (10-20 inches) often underlain by angular raw shale fragments.

SwG - SHALLOW TO GRAVEL: Shallow soils (10-20 inches) resting on clean gravelly or cobbly materials.

SwL - SHALLOW LIMY: Shallow limy soils ( 10-20 inches) underlain by rock virtually impenetrable by plant roots.

SwN - SHALLOW NONLIMY: Shallow neutral to acid soils (10 -20 inches) underlain by rock virtually impenetrable by roots.

Ps - PANSPOTS: Areas where hard clays or other impervious materials lie close to or at the surface in shallow depressions which occupy 20 to 50 percent of the area.(Solodized Solonetz areas where B horizon is exposed in numerous depressions.)

DC - DENSE CLAY: Relatively impervious deep but dispersed clays - may be overlain by thin but ineffectual layers of other materials. The dispersed layer is very hard to extremely hard when dry and very sticky when wet.

TB - THIN BREAKS: Mixed soils of various depths derived from different parent materials that outcrop at different levels forming irregular

slopes from 20 to 65 percent. Trees may occur locally above outcrops. (Breaks with generally calcareous surface soils may be differentiated from others, optionally by states, by using the prefix L for limy.)

Gr - GRAVEL: Uplands where rock fragments of gravel or small stone size compose most of the soil with coarse materials greatly reducing moisture retention with apparent effects on both amount and kind of native vegetation. A sharp-pointed spade ordinarily cannot be forced into these soils.

Vs - VERY SHALLOW: Areas where few roots can penetrate deeper than 10 inches. Outcropping of gravel or bedrock is characteristic. Joints in bedrock may develop deep soil pockets usually marked by tall grasses, shrubs, or stunted trees. Differentiate Very Shallow Limy areas from other VS by using symbol VSL; and Very Shallow Porous (soils over open clean gravel, stones, or fragmented rock with rapid and deep water storage) by using symbol VSP.

SU - SALINE UPLAND: Uplands of ordinary depth where salt and/or alkali accumulations are apparent and halophytes occur over a major part of the area. Common only in arid climates.

Sh - SHALE: Readily puddled uplands where some unweathered angular raw shale fragments are exposed at the surface and little, if any, soil profile development is evident. (Deep slaty shales that do not puddle are usually Savannah Site with some trees and taller grasses than ordinary uplands. Slaty shales also may occur in TB or Bl sites. For either class of shales, if some soil development is apparent, see Shallow Clay.)

Bl - BADLANDS: Nearly barren lands broken by drainages dry most of the year, with intermingled grazable areas too small or too narrow

to justify mapping separately. (Large inaccessible but productive inclusions should be mapped out but with a utilization cut pending access. Large barren areas also should be mapped out.)

GUIDE FOR MAKING RECOMMENDATIONS ON STOCKING *
Basic Table for Normal Soils of each Precipitation Zone
(Ordinary Uplands)

| Average Annual Precipitation Zone (Inches) | Range Condition Percentage & Classes (Animal Unit Months Per Acre) | | | |
|---|---|---|---|---|
| | 100 - EC | 75 - GC | 50 - FC | 25 |
| 35-39 | 1.4 | 1.05 | .7 | .35 |
| 30-34 | 1.2 | .09 | .6 | .03 |
| 25-29 | 1.0 | .75 | .5 | .25 |
| 20-24 | .8 | .06 | .4 | .02 |
| 15-19 | .6 | .45 | .3 | .15 |
| 10-14 | .4 | .03 | .2 | .01 |
| 5-9 | .2 | .15 | .1 | .05 |

* All rates may be much higher if grazing is limited to the season of complete dormancy.

Guide to Departures from Basic Tables
Because of Soil Group Differences*

For Wet Land site: Use 3 times the values for the 20-24" precipitation zone. Values given in stocking rate table for precipitation zones are for soils of normal moisture relations considering each climate.

* These departures do not include utilization cuts because of inaccessibility. Inaccessibility must be considered for specific pastures or ranges taking fencing and stockwater locations into account. Apply any necessary utilization cut to the grazing unit as a whole after AUM's are totaled using this Guide.

For Subirrigated site: Use 2 times the values for the 20-24" precipitation zone.

For Saline Subirrigated and Overflow sites: Use values of next higher precipitation zone.

For Saline Overflow site: Use values one-half step above precipitation zone where located.

For Sands, Savannah, Sandy, Silty, and Clayey sites: Use values given for the precipitation zone. These are values for normal soils of the climate.

For Thin Sandy, Thin Silty, Thin Clayey, Shallow Clay, Shallow to Gravel, Shallow Limy, Shallow Nonlimy, Panspots, and Dense Clay sites: Use values one-half to one zone lower than those used for the precipitation zone.

For Thin Breaks and Gravel sites: Use values one to one and one-half zones lower than those used for the precipitation zone, except in 5-9" precipitation zone use values one-half zone lower.

For Gravel, Very Shallow and Saline Upland sites: Use values one and one-half to two zones lower than those for the precipitation zone but not less than one-half the values for the 5-9" precipitation zone.

For Shale and Badland sites: Use values two to three zones lower than those for the precipitation zone but not less than one-half the values for the 5-9" precipitation zone.

(Notes on Salinity in Soil Relative to Range Sites)

Some growing shrubs take in large amounts of salts and "pump" them from the lower soil to the surface; others do not. Thus, salt content and pH, or both, may vary widely within a few feet, depending on differences in vegetation as well as differences in relief and stratigraphy. Within a small area, soils of widely different characteristics may be found, and at any one spot the salt content may fluctuate with the seasons, weather conditions and irrigation management.

The light-colored flocculated, salty soils are sometimes called " structureless" soils. They are not really structureless, but are softly and finely granular.

Soils dominantly of these characteristics are called Solonchak. Since the salt often enter the soil from beneath, Solonchaks are commonly variable and occur in intricate patterns with zonal and other soils of the region. Yet, "flooded" Solonchaks, which occupy old ponded basins may be relatively uniform, even though exceedingly salty.

With leaching and removal of the excess salts, following improved drainage under natural conditions, the sodium-Solonchak may change to a Solonetz or Solodized - Solonetz,(Panspots Range Site). The solodized - Solonetz soils may have acid A horizons and very slightly acid to strongly alkaline B horizons with well-developed columnar structure. Frequently the leached surface layer of the solodized - Solonetz is blown away during periods of great drouth, exposing the hard clay of the B horizon in the bottoms of shallow pits. Such soils are called truncated solodized-Solonetz. Locally the shallow pits are called "slick-spots" or"scabby spots" i.e. Panspots Range Site.

## Special Classification - Aspen Stands

Aspen stands are often encountered during the course of Missouri River Basin Group classification. The ecological site system used by us for range classification does not lend itself to their classification. The potential plant community, in the case of aspen is usually forest. Aspen stands will be rated by the table below. This special guide (modified from United States Forest Service Research) uses indicator species much as that developed for range sites.

Guide for use of aspen range condition *

| Indicator | Condition Class | | | |
|---|---|---|---|---|
| | Excellent | Good | Fair | Poor |
| Group 1 Decreasers percent | 50-100 | 25-49 | 25-100 | less than 25 |
| Group 2 Increasers percent | 1/ --- | ----- | 25-100 | less than 25 |
| Group 3 Increasers percent | 0-10 | 11-25 | 26-45 | 46-100 |
| Group 4 Invaders percent | 0-5 | 6-15 | 16-35 | 36-54 |

Group 1 Decreasers.

These plants of the aspen stands are found on ranges in excellent to good condition, and are practically absent from range in poor condition. These are all tall, succulent, highly palatable plants that usually disappear under heavy grazing.

* Based on Forest Service Research.

Forbs:

Aconitum columbianum
Aster englemanni
Delphinium spp. (tall)
Heracleum lanatum
Mertensia spp.
Osmorhiza occidentalis
Polemonium foliosissimum
Valeriana occidentalis

Group 2 Increasers

Increasers of Group 2 have a higher preference by livestock.

Forbs:

Agastache urticifolia
Aquilegia coerulea
Astragalus convallarius diversifolius
Balsamorhiza sagittata
B. hookeri
Castilleja spp.
Crepis acuminata
Erigeron spp.
Galium boreale
Helianthella uniflora
Hackelia floribunda
Hedysarum spp.
Ligusticum porteri
Lupinus spp.
Phacelia heterophylla
Senecia serra
Smilacina stellata
Thalictrum fendleri
Trifolium spp.
Vicia americana
Viguiera multiflora

Grasses:

Agropyron subsecundum
Agropyron trachycaulum
Bromus carinatus
Carex spp.
Elymus spp.
Festuca idahoensis
Festuca ovina
Hordeum spp.
Koeleria cristata
Melica spp.
Phleum alpinum
Poa spp. (tall)
Stipa columbiana

Group 3 Increasers

Increasers of Group have a lower preference by livestock.

Forbs:

Aster spp.(except A. engelmanni)
Agoseris spp.
Allium spp.
Dephinium spp. (low)
Fragaria spp.
Gentiana spp.
Geranium spp.
Hydrophyllum spp.
Lathyrus spp.

Grasses:

Festuca thurberi
Muhlenbergia montana
Poa spp. (low growing)
Trisetum spicatum

(Continued )

Group 3 Increasers (Continued)

Forbs:

Osmorhiza obtusa
Penstemon spp.
Plantago tweedyi
Polemonium albiflorum
Potentilla spp.
Ranunculus spp.
Rudbeckia occidentalis
Rumex spp.
Senecio spp. (except S. serra)
Wyethia amplexicaulis
Valeriana edulis
Viola spp.

Shrubs:

Amelanchier spp.
Pachistima myrsinites
Populus tremuloides - (reproduction)
Prunus spp.
Sambucus spp.
Salix spp.
Symphoricarpos spp.

Group 4 Invaders

Invaders are plants most often found on range in very poor condition. They include mat-formers, plants that normally occur on warm, dry sites, ruderals, (weedy perennials) annuals, and in general plants of low palatability.

Annual species:

Amaranthus retroflexus
Chenopodium album
Collinsia tenella
Collomia linearis
Descurania incisa
Galium bifolium
Gayophytum ramosissimum
Lepidium densiflorum
Madia glomerata
Nemophila breviflora
Orthocarpus spp.
Polygonum spp.

Ruderal species:

Cirsium spp.
Lactuca scariola
Oenothera flava
Taraxacum officinale
Tragopogon pratensis

Rhizomatous species:

Achillea lanulosa
Artemisia discolor

Species on warm, dry sites:

Arabis spp.
Eriogonum heracleoides
Gilia aggregata
Stipa lettermani

Others:

Artemisia spp. (woody)
Astragalus spp.(except A. convallarius diversifolius)
Chrysothamnus spp.
Frasera speciosa
Helenium hoopesii
Mahonia repens
Pteridium aquilinum
Rosa woodsii
Stellaria jamesiana

(Continued)

Group 4 Invaders (Continued)

Others:

Urtica gracilis
Veratrum californicum

Several species encountered on aspen range seem to have no relation to any particular range condition. These species, and those for which there is insufficient information for more definite assignment, are:

Forbs:

Corallorrhiza spp.
Epilobium angustifolium
Lithophragma spp.
Scrophularia spp.
Thlaspi glaucum

Grass:

Calamagrostis rubescens

Shrubs:

Ribes spp. and Vaccinium spp.

Note: The Increasers of Groups 2 and 3 first increase in proportion to total vegetation as range condition declines and then decrease as condition becomes even poorer. Group 2 is used as an indicator only in conjunction with Group 1, and then only in the poorer condition classes and Group 3 is not used in "very poor" condition class.

Stocking Rates

Carrying capacities will be secured from appropriate precipitation zones of stocking rates on regular range sites.

Hay pastures are difficult to estimate The following results serve as a guide to production of fair to good hayland in our inventory area.

Journal of American Society of Agronomy
Volume 36, March 1944
Intermountain Forest and Range Experiment Station.

Seven year Average

| Grazing Treatment (Grazing prior to maturation of hay crop.) | Grazing Use Animal Unit days per acre. | Hay equivalent of pasturage in tons per acre. | Hay yields in tons per acre. | Total forage yields tons per acre (Pasture & Hay.) |
|---|---|---|---|---|
| Early.( To May 3) | 10.8 | 0.13 | 1.66 | 1.79 |
| Mid. ( To May 26) | 15.4 | 0.22 | 1.67 | 1.89 |
| Late. ( To June 9) | 38.7 | 0.47 | 1.46 | 1.93 |

James Jensen Ranch at Big Piney, Wyoming.

# Section VIII

## Range Vegetative Types

STANDARD VEGETATIVE TYPE DESCRIPTIONS
( Volume IX Range - Part 10 Studies)
Release 4 -3

Range types depend on aspect - the visual dominance of the most obvious form of vegetation at the time of inspection.

Position in Formula

RANGE
TYPE
↑

o xxxx xxxx xxxx xxxx xx
xx xx x x-x-x xxx x

The following is taken from the release dated 4/30/63

Range types will be derived by first mapping according to current vegetation aspect into the 18 standard vegetative types. These general types will be subdivided or stratified to the extent feasible on the basis of differentials in several vegetative, topographic, and edaphic criteria, considered approximately in the following order: abundance of vegetation, species, composition, slope, exposure, kind of soil, and erosion. Only the most significant and general changes for each of these criteria within an aspect type can be considered, otherwise the range types mapped would become unreasonably small. It is to be remembered that the 160 acres is minimum for ordinary range types, and the average of such types would be somewhat in excess of a section in size. However, the mapping detail will vary with range productivity and complexity.

In many instances, fence lines and natural features that form effective livestock or game barriers will be considered divisions between range types. Under these conditions, a use differential will almost always exist which may have created significant variations in some of the type mapping criteria.

Type writeup numbers and type designations are given to each range type, and these are recorded on the writeup forms. Only the type writeup numbers are shown on the aerial pictures or maps. Type writeup numbers consist of the initial of the examiner's surname and a number beginning with "1" for the first type examined, "2" for the second, etc. In case surname initials are duplicated among party members, the initial of the first name may be added to the front of the type number. Examples of type numbers would S1 and S2, or AS1 and AS2.

The type designation is composed of the number for the aspect vegetative type to which is added the symbols of the most dominant and important plant species in the type. The first plant symbol given is usually that of the species responsible for the aspect or general appearance of the type. The second symbol is frequently that of the most important forage species. However, if the forage species is the same as the aspect species, a second most important plant is next indicated. Usually, three plant symbols are used in the designation. This number may sometimes be two, and rarely four. Examples of types designations are 4 Artr Brte Pose and 1 Boer Hibe Gusa.

Frequently, types of mixed aspect occur; in this case two aspect type numbers are used. The number for the more dominant type is indicated first with the other following in parentheses. Usually, symbols for both aspect species will appear somewhere in the designation. Examples for mixed types are 4 (9) Artr Juut Agsp and 13 (4) Atco Arno.

The waste (7) type is so designated because of its unusability by livestock. Whenever this type is used by game animals, it will be rated

for such use. The designation will be similar to those for mixed types with the aspect vegetation types number in parentheses following the number "7" or the symbol for one of the waste subtypes. Symbols for prominent plant species will follow the numbers as for other types. An example is 7I(5) Cele Agtr Putr.

The aspect vegetative types which are first used in mapping an area into range types are the same as the 18 standard types established some years ago. There appears little reason to change these materially for future use in forage surveys; therefore, only minor modifications have been made. Descriptions are given hereafter along with type number, type name.

Grassland

Type No.

1. (S) Includes grassland other than meadow and secondary meadow. Perennial grasses predominate and determine the aspect, although weeds and browse may be present. Examples of types are: grama -
1. (T) buffalo grass, bunch grass, wheatgrass-sedge, alpine grassland, blue stem.

Meadow

2. Includes areas where sedges, rushes, and moisture-enduring grasses predominate. Two classes of meadows are recognized: wet meadows and dry meadows

Wet meadows are characterized principally by sedges and remain wet or moist throughout the summer. These shall be designated as 2W-Wet Meadow or Marsh.

Type No.

Dry meadows are dominated by grasses rather than sedges and occur as moist meadowlike areas in open timber or intermittent meadow, both of which become moderately dry by mid-summer. These shall be designated as 2-D Dry Meadow.

3 Perennial Forbs (Weeds)

Includes all untimbered areas where perennial weeds predominate over other classes of vegetation. There is very little true weed type, as a weed cover is usually more or less temporary in character and is soon replaced by a more permanent type if the disturbing factor is removed. If there is no great predominance of the weeds over the grass or brush vegetation, and if it is possible to judge that the weed predominance is due to some unnatural factor, the weeds should be disregarded in designating the type and the more stable vegetation should be used as an index. The weeds will then be noted in the subtype.

4 Sagebrush

This type includes all untimbered lands where sagebrush or shrubby species of similar character predominate. The sagebrush lands are usually of different range values and different in season of grazing from the areas which are listed below under browse. Areas dominated by shrubby species of sagebrush including big sagebrush (Artemisia filifolia, A. cana, and A. tripartita. Other shrubby species such as Chrysothamnus should be designated as subtypes when they become dominant in sagebrush areas.

Type No.

4 This and the browse type which follows are sometimes difficult to distinguish from the grass and weed types if aspect rather than the dominant class of forage is used as the distinguishing characteristic. Sagebrush may form only 15 percent of the total vegetation of a type and still its aspect may be that of a sagebrush type.

It may prove desirable, in a given region, to decide on a certain percentage of all the vegetation in the type, say 20 percent, as the minimum proportion of sagebrush that may be present if the area is still to be classified as a 4 type, providing, of course, it does not already have the aspect of some other type. The same will hold true of the browse type.

Browse-Shrub

5 This type includes all untimbered lands where browse, excepting sagebrush or its subtypes, gives the main aspect to the type or is the predominant vegetation. Characteristically it occupies the transition zone of the lower mountain slopes, foothill, and plateau areas. Examples of subtypes are mountain mahogany, bitter brush, willows, Ceanothus-Manzanita, California Chaparral, etc.

Conifer

6 This type includes all range in coniferous timber supporting grasses, weeds, browse, either single or in combination, except as provided under Type 7 and 9. The forage may vary from a pure stand of pine grass, or some other grass, to a pure stand of weeds or browse. It usually, however, consists of grasses, weeds, and browse, and the proportion of each species varies so widely that

Type No.

it is not thought advisable to attempt a division into types with distinct colors. These variations can best be represented by subtypes.

Waste

7 This type includes all areas of dense timber and brush which have no value for grazing domestic livestock or have such slight value that they cannot be used economically, owing either to denseness of standing or down timber or sparseness of forage growth. Large areas of very sparse forage, unless within easy reach of a better type, shall be classified as waste because of the impracticability of running stock over so large an area to get such a small amount of feed. However, a complete write-up of #7 types will usually be desirable in order to record their value for game forage and habitat.

This type also includes other waste areas not strictly in timber or brush and not barren which are so rough or inaccessible as to make their future use improbable.

The subtype designations generally encountered in this type are as follows: 7T-Waste in Dense Timber; 7D-waste in Down Timber; 7B-Waste in Brush; 7R-waste areas where Rocky Character Prevents Use; and 7I- Permanently Inaccessible Areas. Principal species of timber should be shown by symbols.

Barren

8 This type includes all areas on which there is naturally no vegetation, or practically none, including intermittent lake beds, saline flats, active sand dunes, shale, rock slides, lava flows, etc. Areas which have been denuded by overgrazing or other causes

Type No.

should not be confused with areas naturally barren, nor should areas containing only annuals for a part of the year be shown under 8, although these may be without vegetation for the remainder of the year.

9 Pinon - Juniper

This type includes pinon, juniper, pinon-juniper, and digger pine. The character of the range in this type as regards location grazing capacity, and management is sufficiently distinct from the conifer type to justify a separate color. The forage may vary from a pure stand of grasses, weeds or browse to a combination of any two or all. This variation can best be shown by subtype designations.

10 Broad Leaf Trees.

This type includes all range in deciduous timber. The combination of grasses, weeds,and browse, and the proportion of individual species, will vary as in other types.
The principal subtypes which will be encountered are: aspen, cottonwood, oak, birch, alder, ash, elm, etc., when they occur in tree form.

11 Saltbush

This type includes areas where the various salt desert shrubs of the Atriplex family form the predominant vegetation, or give the characteristic aspect. There is sufficient significant difference in the range value and the use of saltbush areas to justify their separation from other desert or semi-desert shrub types.

Type No.

14 Greasewood

This type includes areas where greasewood (Sarcobatus) is the predominant vegetation or gives a characteristic aspect. Characteristically this type occupies valley floors subject to overflow during flood periods or areas underlain with ground-water at shallow depths where the soil is more or less saline. It is sufficiently differentiated from other desert shrubs to justify an exclusive type.

15 Winterfat

This type includes areas where winterfat (Eurotia) gives a characteristic aspect or constitutes the predominant vegetation. Though commonly associated with other semi-desert shrubs, the occurrence of this plant in Utah and Nevada as a type character is of sufficient extent to justify a separate type.

16 Desert Shrub

This is a general type which includes areas where other desert shrubs aside from those separated into individual types, constitute the predominant vegetation or give the characteristic aspect. This type includes several genera which are quite distinctive in type habit such as black brush (Coleogyne), coffee berry (Simmondsia), Catclaw (Acacia, Mimosa, gray molly (Kochia),hopsage (Grayia spinosa), spiny horsebrush (Tetradymia spinescens), Birdfoot Sagebrush (Artemisia pedatifida), but pure types of each are so limited in extent as to not justify separate type. The plant symbols used will be sufficient to indicate the predominant species present.

Type No.

17 Half Shrub

This type includes areas where half shrubs constitute the dominant vegetation or give the characteristic aspect. Half shrubs are semi-woody perennials of low statues such as Aplopappus, Gutierrezia, Artemisia frigida, Eriogonum wrightii, etc. They commonly consist of a woody caudex from which herbaceous stems are produced that die back annually. These genera are sufficiently distinctive in habitat and of wide enough extent in certain localities to justify a separate type designation.

Annuals (Weeds or Grasses)

18 This type includes areas in which annual weeds or annual grasses constitute the dominant vegetation. Both transitory stages and semi-permanent conditions should be included in this type as for example: Russian thistle, downy chess (Bromus tectorum)desert weeds. The plant symbols used will be sufficient to indicate the predominant species present.

Abandoned Lands

Abandoned lands should be classified according to aspect. In mapping, the boundaries should be hachured.

# Section IX

## Range Plant List

# RANGE PLANT LIST
( Montana - list varies with locale of inventory)

The two most common plants are normally listed in the formula by symbol, in order of their relative abundance, following the symbol for the plant determining the aspect. Plant symbols are for Range inventory only. Timber cruises will use appropriate symbol in Forest Survey procedure. Thus, ponderosa pine is Pipo on range inventory or P on timber cruise.

Position in Formula

SYMBOLS FOR THREE PLANT SPECIES

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| x | 0 | 0 | 0 | xxx | xxxx | xxxx | xx |
| xx | xxxx | | xx | x-x-x | | xx | xxx |

| PLANT SYMBOL | SCIENTIFIC BINOMIAL | COMMON NAME (Standardized plant names.) |
|---|---|---|
| | **GRASSES AND GRASSLIKE** | |
| Agcr | Agropyron cristatum | Crested Wheatgrass |
| Agda | " dasystachyum | Thickspike Wheatgrass |
| Aggr | " griffithsi | Griffiths " |
| Agin | " inerme | Beardless " |
| Agit | " intermedium | Intermediate " |
| Agri | " riparium | Streambank " |
| Agsm | " smithi | Bluestem " |
| Agsp | " spicatum | Bluebunch " |
| Agsu | " subsecundum | Bearded " |
| Agtr | " trachycaulum (pauciflorum) | Slender " |
| Agla | Agrostis alba | Redtop |
| Agex | " exarata | Spike Bentgrass |
| Aghy | " hiemalis | (Ticklegrass) Winter Bentgrass |
| Alae | Alopecurus aequalis | Shortawn Foxtail |
| Alal | " alpinus | Alpine " |
| Alpr | " pratensis | Meadow " |
| Anha | Andropogon halli | Sand Bluestem |
| Ansc | " scoparius | Little Bluestem |
| Ange | " gerardi | Big Bluestem ( Not S. P. N.) |
| Arfe | Aristida fendleriana | Fendler Threeawn |
| Arlo | " longiseta | Red Threeawn |
| Avfa | Avena fatua | Wild Oat |
| Besy | Beckmannia syzigachne | American Sloughgrass |

| PLANT SYMBOL | SCIENTIFIC BINOMIAL | COMMON NAME (Standardized plant names) |
|---|---|---|
| | GRASSES (Continued) | |
| Bocu | Bouteloua curtipenda | Side-oats Grama |
| Bogr | " gracilis | Blue Grama |
| Bran | Bromus anomalus | Nodding Brome |
| Brbr | " brizaeformis | Rattle Brome |
| Brca | " carinatus | Mountain Brome |
| Brin | " inermis | Smooth Brome |
| Brja | " japonicus | Japanese Brome |
| Brma | " marginatus | Mountain Brome (Not S.P.N.) |
| Brmo | " mollis | Soft Brome |
| Brpu | " pumpellianus | Pumpelly Brome |
| Brte | " tectorum | Cheatgrass Brome (Downy Brome) |
| Buda | Buchloe dactyloides | Buffalograss |
| Caca | Calamagrostis canadensis | Bluejoint Reedgrass |
| Cain | " inexpansa | Northern " |
| Camo | " montanensis | Plains " |
| Caru | " rubescens | Pinegrass " |
| Calo | Calamovilfa longifolia | Prairie Sandreed |
| Cael | Carex eleocharis | Needleleaf Sedge |
| Cafi | " filifolia | Threadleaf " |
| Cage | " geyeri | Elk Sedge |
| CARE | " spp. | Sedges |
| Dagl | Dactylis glomerata | Orchardgrass |
| Dain | Danthonia intermedia | Timber Danthonia |
| Dasp | " spicata | Poverty " |
| Daun | " unispicata | Onespike " |
| Deca | Deschampsia caespitosa | Tufted Hairgrass |
| Dist | Distichlis stricta | Inland Saltgrass |
| Eccr | Echinochloa crusgalli | Barnyardgrass |
| Elpa | Eleocharis palustris | Common Spikesedge |
| Elca | Elymus canadensis | Canada Wildrye |
| Elci | " cinereus | Basin Wildrye |
| Elgl | " glaucus | Blue Wildrye |
| Eltr | " triticoides | Creeping Wildrye |
| Eqar | Equisetum arvense | Field Horsetail P |
| Feid | Festuca idahoensis | Idaho Fescue |
| Feoc | Festuca octoflora | Sixweeks Fescue |
| Feov | " ovina | Sheep " |
| Fesc | " scabrella | Rough " |

| PLANT SYMBOL | SCIENTIFIC BINOMIAL | COMMON NAME (Standardized plant names) |
|---|---|---|
| | GRASSES (Continued) | |
| Fevi | Festuca viridula | Green Fescue |
| Heki | Hesperochloa kingi | Spikefescue |
| Heho | Helictotrichon hookeri | Spikeoat |
| Hoju | Hordeum jubatum | Foxtail Barley |
| Hopu | " pusillum | Little " |
| JUNC | Juncus spp. | Rush |
| Kocr | Koeleria cristata | Prairie Junegrass |
| Lupa | Luzula parviflora | Millet Woodrush |
| Meba | Melica bulbosa | Oniongrass |
| Mesp | " spectabilis | Showy Oniongrass |
| Muas | Muhlenbergia asperifolia | Alkali Muhly |
| Mucu | " cuspidata | Stoneyhills Muhly |
| Mumo | " montana | Mountain Muhly |
| Musq | " squarrosa | Mat Muhly |
| Orhy | Oryzopsis hymenoides | Indian Ricegrass |
| Paca | Panicum capillare | Common Witchgrass |
| Pavi | " virgatum | Switchgrass |
| Phar | Phalaris arundinacea | Reed Canarygrass |
| Phal | Phleum alpinum | Alpine Timothy |
| Phpr | " pratense | Timothy |
| Phco | Phragmites communis | Common Reed |
| Poam | Poa ampla | Big Bluegrass |
| Poan | " annua | Annual " |
| Poar | " arida | Plains " |
| Pobu | " bulbosa | Bulbous " |
| Poca | " canbyi | Canby " |
| Poco | " compressa | Canada " |
| Pofe | " fendleriana | Mutton " |
| Pone | " nervosa | Wheeler " |
| Popa | " palustris | Fowl " |
| Popr | " pratensis | Kentucky Bluegrass |
| Posc | " scabrella | Pine " |
| Pose | " secunda | Sandberg " |
| Pomo | Polypogon monspeliensis | Rabbitfoot Polypogon |

| PLANT SYMBOL | SCIENTIFIC BINOMIAL | COMMON NAME (Standardized plant names.) |
|---|---|---|
| | GRASSES (Continued) | |
| Puai | Puccinellia airoides (S. P. N. nuttaliana) | Nuttal Alkaligrass |
| Pudi | Puccinellia distans | Weeping Alkaligrass |
| Sepa | Schedonnardus paniculatus | Tumblegrass |
| Scam | Scirpus americanus | American Bulrush |
| Sihy | Sitanion hystrix | Bottlebrush Squirreltail |
| Spgr | Spartina gracilis | Alkali Cordgrass |
| Sppe | " pectinata | Prairie Cordgrass |
| Spai | Sporobolus airoides | Alkali Sacaton |
| Spcr | " cryptandrus | Sand Dropseed |
| Stco (2) (Stcl) | Stipa columbiana | Subalpine Needlegrass |
| Stco (1) | " comata | Needleandthread |
| Stri | " richardsoni | Richardson Needlegrass |
| Stcu | " spartea. curtiseta | Shortawn Porcupinegrass |
| Stvi | " viridula | Green Needlegrass |
| Trma | Triglochin maritima | Shore Podgrass P |
| Trsp | Trisetum spicatum | Spike Trisetum |
| Tyla | Typha latifolia | Common Cattail |
| | FORBS | |
| Acla | Achillea lanulosa | Western Yarrow |
| Acco | Aconitum columbianum | Columbia Monkshood |
| Acar | Actaea arguta | Western Baneberry |
| Acri | Actinea richardsoni | Pingue Actinea P (Rubberweed) |
| Aggl | Agoseris glauca | Pale Agoseris |
| Alca | Allium canadense | Canada Garlic |
| Ambl | Amaranthus blitoides | Prostrate Amaranthus |
| Amar | Ambrosia artemisifolia (elatior) | Common Ragweed |
| Anma | Anaphalis margaritacea | Common Pearleverlasting |
| Anlu | Anemone ludoviciana | American Pasqueflower |
| Anly | Angelica lyalli | Lyall Angelica |
| Anal | Anogra albicaulis | Oenothera Pallida |
| ANTE | Antennaria spp. | Pussytoes |
| Aspi | Aplopappus spinulosis | Ironplant Goldenweed |
| Apan | Apocynum androsaemifolium | Spreading Dogbane |
| Aqfo | Aquilegia formosa | Sitka Columbine |

| PLANT SYMBOL | SCIENTIFIC BINOMIAL | COMMON NAME (Standardized plant names.) |
|---|---|---|
| | FORBS (Continued) | |
| Ardr | Arabis drummondi | Drummond Rockcress |
| Armi | Arctium minus | Smaller Burdock |
| Arco (2) (Arcn) | Arenaria congesta | Ballhead Sandwort |
| Arco | Arnica cordifolia | Heartleaf Arnica |
| ASAR | Asarum spp. | Wild Ginger |
| Assy | Asclepias syriaca | Common Milkweed |
| Asof | Asparagus officinalis | Garden Asparagus |
| Asen | Aster engelmani | Engelmann Aster |
| Asin | Aster integrifolius | Thickstem Aster |
| Asmo | Astragalus mollissimus | Woolly Loco P |
| Asco | Astragalus convallarius | Timber Poisonvetch P |
| ASTR | Astragalus spp. | Loco; Milkvetch; Poisonvetch P |
| (The harmless species are known as Milkvetch. The species causing locoism are called Loco; poisonous species causing symptoms very different from locoism, are called Poisonvetch.) | | |
| ATRI | Atriplex (annual) spp. | Annual Saltbush |
| Basa | Balsamorhiza sagittata | Arrowleaf Balsamroot |
| Bahy | Bassia hyssopifolia | Fivehook Bassia |
| | (Bistorta) see Polygonum | |
| BRAS | Brassica spp. | Mustard |
| Brdo | Brodiaea douglasi | Douglas Brodiaea |
| Caqu | Camassia quamash(Quamasia) | Common Camas |
| Cadr | Cardaria draba (Lepidium) | Pepperweed Whitetop |
| Canu | Calochortus nuttalli | Segolily Mariposa |
| Caro | Campanula rotundifolia | Bluebell |
| Cabp | Capsella bursa-pastoris | Shepherdspurse |
| | (Carum g.) see Perideridia | |
| Cali | Castilleja linariaefolia | Wyoming Paintedcup |
| Cere | Centaurea repens | Russian centaurea |
| Cear | Cerastium arvense | Starry Cerastium |
| | (Chamaenerion) see Epilobium | |
| Chal | Chenopodium album | Lambsquarters Goosefoot |
| Chvi | Chrysopsis villosa | Hairy Goldaster |
| Cioc | Circuta occidentalis | Western Waterhemlock P |
| CIRS | Cirsium spp. | Thistle |
| Ciar | Cirsium arvense | Canada Thistle |
| Clpu | Clarkia pulchella | Clarkia |
| Clse | Cleome serrulata | Bee Spiderflower |
| | (Cogswellia g.) see Lomatium | |
| Copa | Collinsia parviflora | Littleflower Collinsia |
| Coli | Collomia linearis (not S.P.N.) | Pink Collomia |
| Copa | Comandra pallida | Toadflax |

| PLANT SYMBOL | SCIENTIFIC BINOMIAL | COMMON NAME (Standardized plant names) | |
|---|---|---|---|
| | FORBS (Continued) | | |
| Crac | Crepis acuminata | Tapertip Hawksbeard | |
| CRYP | Cryptantha spp. (Oreocary) | Cryptantha | |
| Cyof | Cynoglossum officinale | Common Houndstooth | |
| Debi | Delphinium bicolor | Little Larkspur | P |
| Deba | " barbeyi | Barbey " | P |
| Deme | " menziesi | Menzies " | P |
| DESC | Descuriania spp. | Tansymustard | |
| DODE | Dodecatheon spp. | Shootingstar | |
| Epan | Epilobium angustifolium (Chamaenerion) | Fireweed | |
| Erfl | Erigeron flagellaris | Trailing Fleabane | |
| Erma | " macranthus | Aspen " | |
| ERIO | Eriogonum spp. | Eriogonum | |
| Eras | Erysimum asperum | Plains Erysimum | |
| Eues | Euphorbia esula | Leafy Euphorbia | |
| Frve | Fragaria vesca | European Strawberry | |
| Frsp | Frasera speciosa | Showy Frasera | |
| GAIL | Gaillardia spp. | Gaillardia | |
| Gaar | " aristata | Common Perennial Gaillard | |
| Gabo | Galium boreale | Northern Bedstraw | |
| Gaco | Gaura coccinea | Scarlet Gaura | |
| Gevi | Geranium viscosissimum | Sticky Geranium | |
| | (Geum t.) see Sieversa | | |
| Giag | Gilia aggregata | Skyrocket Gilia | |
| Glle | Glycyrrhiza lepidota | American Licorice | |
| Grsq | Grindelia squarrosa | Curlycup Gumweed | |
| Hagl | Halogeton glomeratus | Halogeton | |
| Hepa | Hedysarum pabulare | Northern Sweetvetch | |
| Heho | Helenium hoopesi | Orange Sneezeweed | |
| Heun | Helianthella uniflora | Oneflower Helianthella | |
| Hela | Heracleum lanatum | Common Cowparsnip | |
| Hecy | Heuchera cylindrica | Roundleaf Allumroot | |
| Hial | Hieracium albiflorum | White Hawkweed | |
| Hyca | Hydrophyllum capitatum | Ballhead Waterleaf | |
| Hype | Hypericum perforatum | Common St. Johnswort | D |

| PLANT SYMBOL | SCIENTIFIC BINOMIAL | COMMON NAME (Standardized plant names.) |
|---|---|---|
| | FORBS (Continued) | |
| Irmi | Iris missouriensis | Rocky Mountain Iris P |
| Ivax | Iva axillaris | Poverty Sumpweed |
| Kosc | Kochia scoparia | Belvedere Summercypress |
| Lase | Lactuca serriola (scariola) | Prickly Lettuce |
| Lapu | Lactuca pulchella | Chicory Lettuce |
| LAPP | Lappula spp. | Stickseed |
| | (Leontodon t.) see Taraxacum | |
| | (Lepidium d.) see Cardaria | |
| Lear | Lesquerella argentea | Silver Bladderpod |
| Lemo | Leucocrinum montanum | Star Lily |
| Lere | Lewisia rediviva | Bitterroot Lewisia |
| Lipu | Liatrus punctata | Dotted Gayfeather |
| Lifi | Ligusticum filicinum | Fernleaf Ligusticum |
| Livu | Linaria vulgaris | Butter-and-eggs Toadflax |
| Lile | Linum lewisi | Lewis Flax |
| LITH | Lithophragma spp. | Woodlandstar |
| Liar | Lithospermum arvense | Corn Gromwell |
| Loge | Lomatium geyeri | Geyer Biscuitroot |
| Loma | Lomatium macrocarpum | Bigseed Lomatium |
| Luca | Lupinus caudatus | Tailcup Lupine P |
| Lyju | Lygodesmia juncea | Rush Skeletonplant |
| Maro | Malva rotundifolia | Running Mallow |
| Mesa | Medicago sativa | Alfalfa |
| Meof | Melilotus officinalis | Yellow Sweetclover |
| Meal | Mentzelia albicaulis | Whitestem Mentzelia |
| Melo | Mertensia longiflora (pulchella) | Small Bluebells |
| Mome | Monarda menthaefolia | Mintleaf Beebalm |
| Most | Monarda stricta | Mint |
| Momu | Monolepis nuttalliana | Nuttall Monolepsis |
| Myal | Myosotis alpestris | Alpine Forget-me-not |
| | Oreocarya (see Cryptantha) | |
| Orlu | Orthocarpus luteus | Yellow Owlclover |
| Osoc | Osmorhiza occidentalis | Sweetanise |
| Oxla | Oxytropis lamberti | Lambert Crazyweed P |
| Pegr | Pedicularis groenlandica | Elephanthead Pedicularis |

| PLANT SYMBOL | SCIENTIFIC BINOMIAL | COMMON NAME (Standardized plant names.) |
|---|---|---|
| | FORBS (Continued) | |
| Pery | Pentstemon rydbergi | Rydberg pentstemon |
| PENT | Pentstemon spp. | Pentstemon |
| Pega | Perideridia gairdneri (Carum) | Yampa |
| Peol | Petalostemon oligophyluss | Slender White Prairclover |
| Phhe | Phacelia heterophylla | Varileaf Phacelia |
| Phho | Phlox hoodi | Hoods Phlox |
| Plpu | Plantago purshi | Wooly Indianwheat |
| Popu | Polemonium pulcherrimum | Skunkleaf Polemonium |
| Pobi | Polygonum bistorta ( Bistorta) | European Bistort |
| Podo | Polygonum douglasi | Douglas Knotweed |
| Pogl | Potentilla glandulosa | Gland Cinquefoil |
| POTE | Potentilla spp. | Cinquefoil |
| PSOR | Psoralea spp. | Scurfpea |
| Ptaq | Pteridium aquilinum pubescens | Western Bracken P |
| | Quamasia hyacinthina (see Camassia q.) | |
| Ragl | Ranunculus glaberrimus | Sagebrush Buttercup |
| Raco | Ratibida comunifera | Upright Prairiecone-flower |
| Ruhi | Rudbeckia hirta | Blackeyed Susan |
| Ruve | Rumex venosus | Veiny Dock |
| Rucr | Rumex crispus | Curly Dock |
| Saka | Salsola kali | Common Russionthistle |
| Saar | Saxifrage arguta | Brook Saxifrage |
| Sest | Sedum stenapetalum | Stonecrop |
| Seau | Senecio aureus | Golden Groundsel |
| Sein | Senecio intergerrimus | Lambstongue Groundsel P |
| Seca | Senecio canus | Woolly Groundsel |
| SIDA | Sidalcea | Checkermallow |
| SIDE | Sideranthus spp. | Ironplant |
| Sian | Sisyrinchium angustifolium | Common Blue-eyed Grass |
| Sici | Sieversia ciliata ( Geum) | Prairiesmoke Sieversia |
| Smra | Smilacina racemosa | Feather Solomonplume |
| Soel | Solidago elongata | Creek Goldenrod |
| Soar | Sonchus arvensis | Field Sowthistle |
| | (Sophia) see Descurania | |
| Spco | Sphaeralcea coccinea | Scarlet Globemallow |
| STAN | Stanleya spp. | Princesplume |

| PLANT SYMBOL | SCIENTIFIC BINOMIAL | COMMON NAME (Standardized plant names.) |
|---|---|---|
| | FORBS (Continued) | |
| Stme | Stellaria media | Chickweed |
| Tavu | Tanacetum vulgare | Common Tansy |
| Taof | Taraxacum officinale (Leontodon) | Common Dandelion |
| Thar | Thlaspi arvense | Pennycress |
| Thfe | Thalictrum fendleri | Meadow Rue |
| Thmo | Thermopsis montana | Mountain Goldenpea |
| Toex | Townsendia exscapa | Stemless Townsendia |
| Tory | Toxicodendron rydbergi | Western Poisonivy |
| Trpo | Tragopogon porriofolius | Vegetable Oyster |
| TRIF | Trifolium spp. | Clover |
| Urdi | Urtica dioica | Bigsting Nettle |
| VALE | Valeriana spp. | Valerian |
| Veca | Veratrum californicum | California Falsehellebore |
| Vebl | Verbascum blattaria | Moth Mullein |
| Viam | Vicia americana | American Vetch |
| Vimu | Viguiera multiflora | Showy Goldeneye |
| Viad | Viola adunca | Hook Violet |
| Wyam | Wyethia amplexicaulis | Mulesears Wyethia |
| XANT | Xanthium spp. | Cocklebur |
| Xete | Xerophyllum tenax | Common Beargrass |
| Zyve | Zigadenus venenosus | Meadow Deathcamas |
| Zyel | Zigadenus elegans | Mountain Deathcamas |
| Zygr | Zigadenus gramineus | Greasy Deathcamas |
| | SHRUBS | |
| Acgl | Acer glabrum | Rocky Mountain Maple |
| Acne | Acer negundo | Boxelder |
| Amal | Amelanchier alnifolia | Saskatoon Serviceberry |
| Arca | Artemisia cana | Silver Sagebrush |
| Ardr | Artemisia dracunculoides | False-Tarragon Sagewort |
| Arfr | Artemisia frigida | Fringed Sagewort |
| Arlo | Artemisia longifolia | Longleaf sagewort |
| Arlu | Artemisia ludoviciana | Louisiana Sagewort |
| Artr | Artemisia tridentata | Big Sagebrush |
| Aruv | Arctostaphylos uva-ursi | Bearberry Kinnikinnick |
| Atca | Atriplex canescens | Fourwing Saltbush |
| Atco | Atriplex confertifolia | Shadscale Saltbush |

| PLANT SYMBOL | SCIENTIFIC BINOMIAL | COMMON NAME (Standardized plant names,) |
|---|---|---|
| | SHRUBS (Continued) | |
| Atnu | Atriplex gardneri | Gardner Saltbush |
| | (Berberis repens) see Mahonia repens | |
| BETU | Betula spp. | Birch |
| Caar | Caragana arborescens | Caragana |
| Ceve | Ceanothus velutinus | Snowbrush Ceanothus |
| Cele | Cercocarpus ledifolius | Curlleaf Mountain Mahogany |
| Cemo | Cercocarpus montanus | Mountain Mahogany |
| Chna | Chrysothamnus nauseosus | Rubber Rabbitbrush |
| Chvi | Chrysothamnus viscidiflorus | Douglas Rabbitbrush |
| CHRY | Chrysothamnus spp. | Rabbitbrush |
| Cost | Cornus stolonifera | Redosier Dogwood |
| CRAT | Crataegus spp. | Hawthorn |
| Elan | Eleagnus angustifolia | Russian Olive |
| Elco | Eleagnus commutata | Silver-berry |
| Eula | Eurotia lanata | Common Winterfat |
| Frpe | Fraxinus pennsylvanica | Red Ash |
| Gusa | Gutierrezia sarothrae | Broom Snakeweed |
| Juco | Juniperus communis | Common Juniper |
| Juho | Juniperus horizontalis | Creeping Juniper |
| Jusc | Juniperus scopulorum | Rocky Mountain Juniper |
| Laoc | Larix occidentalis | Western Larch (Tamarack) |
| LONI | Lonicera spp. | Honeysuckle |
| Mare | Mahonia repens (Berberis r.) | Creeping Mahonia |
| Oppo | Opuntia polycantha | Prickly Pear |
| OPUN | Opuntia spp. | Ground Cactus |
| Opfr | Opuntia fragilis | Brittle Pricklypear |
| Phle | Philadelphus lewisi | Lewis Mockorange |
| Phma | Physocarpus malvaceus | Mallow Ninebark |
| Pien | Picea engelmanni | Engelmann Spruce |
| Pipu | Picea pungens | Colorado Spruce |
| Pico | Pinus contorta | Lodgepole Pine |
| Pipo | Pinus ponderosa | Ponderosa Pine |

| PLANT SYMBOL | SCIENTIFIC BINOMIAL | COMMON NAME (Standardized plant names.) |
|---|---|---|
| | SHRUBS (Continued) | |
| Posa | Populus sargenti | Plains Cottonwood |
| Potr | Populus tremuloides | Quaking Aspen |
| POPU | Populus spp. | Cottonwood |
| Pofr | Potentilla fruticosa | Bush Cinquefoil |
| Psme | Pseudotsuga menziesi | Douglasfir |
| Pram | Prunus Americana | American Plum |
| Prvi | Prunus virginiana | Common Chokecherry P |
| Putr | Purshia tridentata | Antelope Bitterbrush |
| Quma | Quercus macrocarpa | Bur Oak |
| Riau | Ribes aureum | Yellowleaf Golden Currant |
| Rice | Ribes cereum | Wax Squaw Currant |
| Rimo | Ribes montigenum | Gooseberry Prickly Currant |
| Rise | Ribes setosum | Redshoot Gooseberry |
| Rivi | Ribes viscosissimum | Sticky Currant |
| Roar | Rosa arkansana | Arkansas Rose |
| Rowi | Rosa woodsi | Woods Rose |
| ROSA | Rosa spp. | Rose |
| Rhtr | Rhus trilobata | Skunkbrush Sumac |
| RUBU | Rubus spp. | Raspberry |
| SALI | Salix spp. | Willow |
| SAMB | Sambucus spp. | Elderberry |
| Save | Sarcobatus vermiculatus | Black Greasewood |
| Shar | Sherpherdia argentea | Silver Buffalo-berry |
| Shca | Sherpherdia canadensis | Russian Buffalo - berry |
| Sosc | Sorbus scopulina | Greene's Mountain Ash |
| Spbe | Spiraea betulifolia | Birchleaf Spiraea |
| Syal | Symphoricarpos albus | Common Snowberry |
| Syoc | Symphoricarpos occidentalis | Western Snowberry |
| SYMP[illegible] | Symphoricarpos spp. | Snowberry |
| Teca | Tetradymia canescens | Gray Horsebrush P |
| Tesp | Tetradymia spinosa | Cottonthorn Horsebrush P |
| TETR | Tetradymia spp. | Horsebrush P |
| Thpl | Thuja plicata | Giant Arborvitae |

# Section X

## Forestry

Our inventory of timber and woodlands is a part of resource inventory within the framework of land classification. It is less intensive than that required, for example, of a timber sale. We usually encounter limited acreages of timber. In our classification of land, watershed and aesthetic values exceed estimated timber values. However, large areas with timber values paramount will be inventoried by the intensive procedures contained in the Bureau Manual.

Timber types may be of greatest value for recreation or watershed. Notes to that effect - and the needed development that will bring the greatest benefit to the largest number should be narrated on the type writeup.

Any timber type more important as a range forage type will be rated by the procedures of the Range Classification Section. These are usually pinon-juniper, browse and noncommercial aspen. The usual detailed notes will include any comments on the timber reproduction etc.

Most forest land to be evaluated as such follows:
Those (a) lands which are at least 10 percent stocked by trees of any size and capable of producing timber or other wood products, or of exerting an influence on the climate or on the water regime; (b) land from which the trees described in (a) have been removed to less than 10 percent stocking but which has not been developed for other use; and (c) planted areas. The minimum area for classifying forest and nonforest is 10 acres in Wyoming, Colorado, and 5 acres in Montana. Stringer types must be at least 120 feet wide regardless of length, in order to qualify as forest land. In addition roads, streams, canals, rights-of-way, clearings, and treeless strips within the forest but less than 120 feet wide are also considered forest land.

Commercial forest land is (a) producing,or physically capable of producing, usable crops of wood (usually sawtimber); (b) economically available now or prospectively; and (c) not withdrawn from timber utilization. All commercial forest land will be subdivided into the types, stand-size classes, and stocking classes.

Two general kinds of noncommercial forest land are recognized, productive and nonproductive.

Productive - Public forest land withdrawn from timber utilization through statute, ordinance, or administrative order but which otherwise qualifies as commercial forest land. Productive noncommercial forest land will be subdivided into the same forest types, stand-size classes, and stocking classes as commercial forest land.

Unproductive - Forest land capable of yielding usable wood products (usually sawtimber) because of adverse site conditions, or so physically inaccessible as to be unavailable economically now or prospectively.

Because the classification - noncommercial forest land - includes several types of forest land a simple and precise definition is difficult to write. Within this category are included forest lands capable of producing sawtimber but unavailable for harvest by reason of dedication to some other purpose. Also included are forest lands incapable of producing sawtimber. Further, lands producing or capable of producing sawtimber but impossible to log now or prospectively are also included. Application of the term noncommercial to these several types of forest land complicates further any definition that might be offered. Each area under consideration must be judged separately on its own characteristics. Fieldmen should visit local cutting operations to obtain a gauge of the forest land being cut over today by commercial operators. A fairly safe assumption is that stands similar to those being cut are operable under present economic and technologic conditions and are therefore in the

category of commercial forest land. There are, however, exceptions even to this.

As aids in recognizing noncommercial forest lands use the following examples:

1. Land that is growing or capable of growing sawtimber but is not available for harvesting because of official dedication for some other purpose. This is productive noncommercial forest land.

2. Small blocks of forest land that are completely surrounded by terrain that prohibits harvesting economically are noncommercial. They are also called unproductive from an economic standpoint. Remoteness alone is not an acceptable reason for calling an area noncommercial. Remember, roads will be built and new and cheaper methods of logging and transportation will be developed that will make presently remote areas economic to operate in the future.

3. These are areas producing good individual trees but are so strewn with boulders or cliffs that logging is impossible. Such areas are noncommercial.

4. Other areas do not have the soil, water, weather aspect and other factors needed for growing usable sawtimber. These are probably the easiest to recognize. The timber is short scrubby, slow growing and few, if any, of the stems will make a sawlog. These forest areas are often at high elevations. They may be extremely valuable for watershed, grazing, or other purposes.

COVER CLASSES

Commercial Forest Types - Basis for Classification

The species having the predominance of cubic-foot volume of sawtimber trees in sawtimber stands, pole trees in poletimber stands, or number of stems in seedling-sapling stands will determine the type designation. Where no species comprises 50 percent or more of the stand, the stand should be types on the basis of the plurality of cubic-foot volume or number of trees. For example, a stand having 55 percent of its cubic-foot volume in Douglas-fir trees would be types as Douglas-fir. A stand having 40 percent of its cubic-foot volume in ponderosa pine, 30 percent in Douglas-fir, 15 percent in lodgepole pine, and 15 percent in white fir would be typed as ponderosa pine.

Type Name

Douglas-fir - Forests in which 50 percent or more or a plurality of the stand is Douglas-fir. Map Symbol D

Ponderosa pine - Forests in which 50 percent or more or a plurality of the stand is ponderosa pine. Map Symbol P

Lodgepole pine - Forests in which 50 percent or more or a plurality of the stand is lodgepole pine Map Symbol LP

Fir-spruce - Forests in which 50 percent or more or a plurality of the stand is true fir (Abies spp.), Engelmann spruce, or Colorado blue spruce, single or in combination. Map symbol SF

Hardwoods - Forests in which 50 percent or more or a plurality of the stand is aspen, cottonwood, or other western hardwoods, singly or in combination.
Map symbol Aspen - A, Cottonwood - Co, other hardwoods - OH

Commercial aspen forest land is defined as: (a) Aspen areas

obviously capable of growing thrifty aspen stands with a majority of the trees containing a minimum merchantable length of 16 feet to a 4-inch top dib, reasonable straight and sound; (b) areas on which poor quality aspen is found but which by evidence on the ground may indicate the capability of reverting to conifer stands of commercial character. Judge capability by presence of conifer understories and intermingled trees; or occupancy of similar sites and aspects on adjacent commercial conifer stands.

## Noncommercial Forest Types

(See Range Classification for noncommercial Forest)

Aspen - Symbol NA

Noncommercial aspen forest land is defined as aspen areas obviously incapable of producing thrifty aspen stands or of being capable of reverting to conifer stands of commercial character. ( Use Guide to Aspen Stands)

Chaparral - Symbol NC

Lands supporting heavily branched dwarf trees or shrubs, the crown canopy of which covers more than 50 percent of the ground and whose primary value is watershed protection.

Pinon-Juniper - Symbol NP

Noncommercial pinon-juniper forest land includes all pinon-juniper forests in which 50 percent or more of the stand is pinon pine and/or juniper.

Other - Symbol NO

All other noncommercial forest land regardless of cover type.

## Definitions

### Breast Height

Breast height for this survey is defined as being 4-1/2 feet above the mean ground level.

## Merchantable Top

The point on the bole of a sawtimber tree coinciding with the minimum diameter inside bark for a merchantable sawlog. Top diameters will vary with the dbh of the tree as listed below:

| DBH (inches) | Top DIB (inches) |
|---|---|
| 10,11 | 5 |
| 12,13,14,15 | 6 |
| 16,17,18 | 7 |
| 19,20,21 | 8 |
| 22,23,24,25 | 9 |
| 26 + | 10 |

Tops vary by diameter classes and are precisely defined as follows:

Top dib = .3dbh + 2.0 with 10.0 inch maximum

## Log Height

The number of 16-foot sawlogs in sawtimber trees to the merchantable top, rounded to the nearest log. Where the top is broken out the log height should be estimated to where the merchantable top would have been and a deduction made for cull.

## Tree Size

Sawtimber trees - Trees 11.0" dbh and larger

Pole trees - Trees 5.0" to but not including 11.0" dbh

Seedling-sapling trees - Well-eastablished seedlings up to but not including 5.0" dbh. Three size classes are recognized:

Well-established but not including 1.0" dbh

1.0" dbh to but not including 3.0" dbh

3.0" dbh to but not including 5.0" dbh

## Sawlog

A minimum sawlog must be 16 feet long to a minimum top dib of 5" and must have one-third or more of its gross board-foot volume in

sonnd merchantable material. Except for 1-log sawtimber trees the minimum sawlog shall be 10 feet long.

STAND-SIZE CLASSES

Sawtimber - Map symbol 9

Stands with a minimum net volume per acre of 1,500 boardfeet, Scribner Decimal C rule, in trees of sawtimber size (11.0" + dbh).

Poletimber - Map symbol 8

Stands failing to meet the sawtimber stand specifications, but at least 10 percent stocked with poletimber and larger ( 5.0" dbh and larger) trees with at least half the minimum stocking or 5 percent, in poletimber trees (5.0" to but not including 11.0" dbh).

Stands which are 10 percent or more stocked with sawtimber and poletimber trees, but with less than 1,500 net board feet per acre Scriber Decimal C rule and with few or no poletimber trees will not be classed as poletimber areas. Such areas will be classed as either seedling-sapling or nonstocked according to the definition of these classes.

Seedling-Sapling Map symbol 7

Stands not qualifying as either sawtimber or poletimber stands, but having at least 10 percent stocking of trees of commercial species and with at least half the minimum stocking, or 5 percent, in seedling-sapling trees (well-established seedlings up to, but not including 5.0" dbh).

Non-stocked and Deforested Map symbol 6

Areas not qualifying as sawtimber, poletimber, or seedling-sapling stands i.e., normally less than 10 percent stocked. May in some cases include areas more than 10 percent stocked, e.g., stands more than 10 percent stocked with sawtimber trees but with insufficient board-foot volume to qualify as sawtimber stands.

Nonstocked and deforested areas will be classified by the latest forest type which occupied the area.

## STOCKING CLASSES

Stocking is the extent to which growing space is effectively utilized by present or potential growing stock trees of commercial species. Stocking may be measured in terms of number of trees, volume, basal area, crown cover or other criteria or combination of criteria. Sawtimber stands will be classed as to stocking on a dual crown cover basis. Poletimber and seeling and sapling stands will be classed as to stocking on the basis of crown closure of all trees, except where the crowns of trees are too small to see on aerial photographs, in which case the number of trees, as determined by ground check, will be the basis for estimating stocking class.

Crown Closure Specifications
( or number of trees)

| | Symbol |
|---|---|
| Nonstocked -0- 9 percent | 0 |
| Poorly stocked - 10 -39 percent | - |
| Medium stocked - 40 -69 percent | = |
| Well stocked - 70 + percent | ≡ |

Stocking Stand-Size Classes

Sawtimber Stands (Dual Classification)

Crown density by all trees

Crown density by sawtimber trees only.

Example: P9 ≡ = Ponderosa pine, sawtimber, well stocked by all trees, medium stocked by sawtimber trees.

Poletimber stands

Crown density estimate by all trees of the stand

Example: LP8 ≡ Lodgepole pine, poletimber stand, well stocked by all trees.

Seedling-Sapling Stands

Crown density by all trees or number of trees in the stand.

Example: L7 SF Spruce-fir, seedling-sapling stand, well stocked by all trees.

Stocking class will not be shwon on the mapped type strata for Aspen sawtimber, pole and seedling-sapling stands, A9, A8, and A7, respectively.

Salvable Dead

All dead trees, including morality trees, 5.0" dbh and larger, standing and down but not lying on the ground which have 50 percent or more of their cubic foot volume in sound wood. Salvable dead trees are tallied by two merchantability classes:

Suitable for lumber - Trees of sawtimber size which have at least one sound log not lower than grade 3 and free from spiral grain checks.

Suitable for other purposes - Salvable dead trees which are not suitable for lumber but suitable for pulp, poles, or other uses.

GUIDES FOR ESTIMATING TIME SINCE MORTALITY

| Died within 5 years | Species | Died more than 5 years ago |
|---|---|---|
| Some foliage, 50% or more of twigs, nearly all branches remaining.<br>Bark nearly all present | Ponderosa Pine | No foliage<br>Large limbs falling<br>Considerable bark sloughing<br>Less than 50% of branches and twigs remaining |
| Some foliage, 30% or more of twigs, 50% or more of branches remaining<br>Little sloughing of bark | Spruce | No foliage<br>Less than 50% of branches and less than 30% of twigs remaining.<br>Considerable bark sloughing.<br>Large limbs falling. |
| Some foliage, 75% or more of twigs, 75% or more of branches remaining | Lodgepole Pine | No foliage.<br>Less than 75% of twigs or branches remaining.<br>Bark sloughing. |

| Died within 5 years | Species | Died more than 5 years ago |
|---|---|---|
| Some foliage, 50% or more of twigs, 75% or more of branches remaining. Bark intact | Douglas-fir | No foliage<br>Less than 50% of twigs or 75% of branches remaining<br>Large limbs falling<br>Bark sloughing (except very young trees.) |
| Some foliage, 50% of twigs, 75% or more of branches remaining. Smooth bark, unbroken, not curled away from bole | True firs | No foliage<br>Less than 50% of twigs, less than 75% of branches remaining.<br>Large limbs falling<br>Smooth bark extensively checked and curled, considerable sloughing. |
| 50% or more of bark still attached in some degree to bole. | Aspen | No foliage<br>Bark fallen completely free of bole, or less than 50% attached in any degree. |

The presence of sporophores of sapwood-rotting fungi such as Polyporus volvatus, Fomes pinicola, etc., will be accepted as evidence that the tree has been dead more than 5 years.

## Merchantability Classes

### Merchantable

Live sound trees which meet the following specifications:

Sawtimber trees - Live sawtimber trees containing at least one 10-foot sawlog to a merchantable top dib and having one-third or more of their gross board-foot volume in sound merchantable material and which are likely to eventually contain at least a 16-foot minimum sawlog. Trees which contain a sawlog 10 feet long or longer but which are so girdled, gnarled, broomed out, or otherwise injured or deformed as to make it unlikely they will ever contain a 16-foot sawlog will not be called merchantable.

Poletimber trees - Live poletimber trees which are likely to grow into sound merchantable sawtimber trees. Pole trees with rot will not be called merchantable.

Seedling-sapling trees - Live seedling-sapling trees which are of such form and quality as to be considered potential poletimber trees. Seedling-sapling trees

which do not qualify as "merchantable" are not tallied.

Sound Cull

Sawtimber trees - Live sawtimber trees having more than two-thirds of their gross board-foot volume cull providing at least one-half of this cull is the result of defects such as sweep, crook, or other sound defect. Also included are sound trees 11.0" dbh and larger too short to contain at least one minimum sawlog.

Poletimber trees - Live sound poletimber trees which are unlikely to grow into merchantable sawtimber trees because of serious fire and basal scars, broken tops, severe mistletoe, severe crooks, or girdling by porcupines will be called sound culls. Pole trees with any rot will be recorded as rotten culls.

Seedling-sapling trees. - No sound cull trees recognized. Cull trees are not recorded, but will be marked with a single axe blaze.

Rotten Cull

Sawtimber trees - Live trees which have more than two-thirds of their gross board-foot volume culled, more than half of which is due to rot.

Poletimber trees - Live trees showing any evidence of rot on the main stem.

Seedling-sapling trees - No rotten cull trees reocgnized. Cull trees are not recorded, but will be marked with a single axe blaze.

Mortality

All trees 5.0" dbh and larger, standing and down, which have died within the past 5 years. Guides for estimating whether or not a tree died within the past 5 years are given on page

(NOTE: Trees which would have been culled while alive because of shape or form should not be counted as mortality )

Field Technique

Cruise strips should cross ridges and streams at right angles. 5% Cruise is used on all timbered areas. One run to each forty acres with 8 plots, $2\frac{1}{2}$ chains between each plot. Each plot has a radius of 59 feet and an area of $\frac{1}{4}$ acre. $2\frac{1}{2}$% cruise on woodland areas and on closed hardwood types, one run to each forty acres with 8 plots, $2\frac{1}{2}$ chains between each plot. Each plot has a radius of 59 feet, and an area of $\frac{1}{4}$ acre.

On woodland ($2\frac{1}{2}$% cruise) notes should be made on the type sheet under the heading "Remarks" on past use for fuelwood. Juniper will be estimated as to the present quantity of fence posts.

Corner posts should be 8 feet long with a minimum 5 inch top diameter. Line posts should be $6\frac{1}{2}$ feet long with a 3 to 5 inch top diameter. Large cuts that can be split to produce a number of fence posts should be estimated in terms of the total number of line or corner posts that can be obtained. If there is any question whether stems or portions thereof should be tallied in terms of corner posts or if line posts preference should be given to line posts. A $2\frac{1}{2}$ cruise will give a good indication of available posts or post depletion. Evidences of cutting compared to remaining stems of post size will indicate the degree of depletion. On all tracts of public domain, note the degree of use for fence posts under "Remarks".

Defect allowance is estimated on each plot, and the percentage is indicated at the bottom o f the tally sheet for each forty.

Seedling and Pole Counts.

Counts for seedlings and poles are indicated on the back of the tally sheet. Plots of mill acre size (6.6' on a side) will be used in these counts, the plots being taken at the center of the quarter acre circular plots.

Seedlings and poles by species will be tabulated for each mill acre

plot as shown on the tally sheet. Lodgepole Pine will be tallied as 5" and under in one class (reproduction) and 6" in the other class (poles). Other species will be tabulated such that 5" and under are in the Reproduction Class and the 6", 8" and 10" are grouped under the pole class.

Defect Allowance.

Correction is necessary to obtain from the tally sheet the proper amount of merchantable timber on a forty. Such correction will be shown on the front of the tally sheet as a percentage reduction of the gross volume. This is known as the defect allowance, the estimated loss that will occur, and that must be deducted on the tally sheet from the gross volume of the strip.

On each plot the trees are recorded by DBH and number of merchantable logs or half-logs as to species and whether they are merchantable or cull. Computations of volume are made for the merchantable trees in the office.

Breakage is not an important item in our inventory areas.

Computation of Cruise

The steps to be taken in computing the volume on a forty are as follows:

(1) Read from the volume tables the volume for each species and size of tree and enter in the colume indicated for volume on the tally sheet. This will be the gross volume.

(2) Total the gross volumes at the bottom of the tally sheet for each species.

(3) Deduct the blanket percentage for defect to get the net volume for the strip. This will be deducted from all species according to the percentage estimated during the cruise.

(4) Determine the ratio factor for applying the sample against the entire forty by dividing the acreage in the forty by the acreage sampled.

(5) Multiply the net volume for the strip by the ratio factor to get the net forty total.

(6) Enter the net volume for the forty at the bottom of the tally sheet.

(7) Enter the net volume, by species, on the forty volume summary sheet.

References to National Land Reserve are maintained in quoted material. In reports you will use "Public Domain" or "Public Lands Administered by the Bureau."

# Section XI

## Land Classification

Classification of land proceeds under the provision of Section 7 of the Taylor Grazing Act as amended (43 U. S. C. 315f, CFR Part 296) and other laws. The Bureau Manual, Volume V Lands, Chapter 6.1 covers land classification. Our activities are governed by Federal Codes and Manual procedures. The material following is a guide and not a substitute for the manual. All quotes unless otherwise identified are from the Volume V, Lands Manual, Part 6 Land Classification.

Objective of Land Classification.

"Classifications are based on the accurate application of laws, regulations, and policies, and are founded on adequate investigation of the physical characteristics of the lands and the economic and social factors involved. Classifications are made in clear, concise, and definite terms in proper form for recording in the public land records; information is presented in a manner to be readily usable by adjudication officers in preparing decisions; and by management officers in public land management."

Our Missouri River Basin land classification is the assembly and analysis of information; we document our determinations of leasing and disposal of public lands under the non-mineral public land laws.

Classification embraces:

1. Area Classification (AC) inventory of all lands regardless of status.
2. Individual Tract or Isolated Tract (IT) Classification inventory of individual tracts of public domain.

We classify public lands because, "All vacant public lands outside of Alaska and of grazing districts are withdrawn and reserved for among other things, classification by provisions of the general orders of withdrawal. a/ Such lands may not be leased or disposed of under the nonmineral public land laws unless and until the lands are determined to be

Proper for such lease or disposal by an authorized classification officer.

" 1. Vacant public lands are those lands which are subject to "private appropriation" by the first qualified person who observes the necessary procedural requirements. The unreserved public lands in Alaska form the great bulk of public lands in this category.

2. The National Land Reserve (public domain) encompasses all those lands which are subject to private appropriation only if and after the Secretary (or his delegate) classifies the lands in appropriate fashion for appropriation under a certain law or laws and opens the lands to such appropriation. This essentially involves the revocation of a withdrawal to serve a limited purpose.

3. Other Reserved Lands ecompasses all those lands which are subject to private appropriation only after the Secretary (or his principal assistants, under present procedures) or the Congress revokes the overlying order of withdrawal in its entirety. This essentially involves the revocation of a withdrawal to serve general purposes. If, upon revocation, the lands become part of the National Land Reserve, then the principles in Item 2 preceding take over. If, upon revocation, the lands become vacant public lands, as they generally do in Alaska, then the principles in Item 1 preceding take over.

The National Land Reserve

The National Land Reserve has been defined as including two classes of lands:

1. Lands withdrawn and reserved for classification, and pending determination of the most useful purpose to which such land may be put in consideration of the provisions of the Act of June 28, 1934 (48 Stat. 1269; 43 U.S.C. 314-315n, 1171) and for conservation and development of natural resources by E. O. No.6910 of November26, 1934,

and E. O. 6964 of February 5, 1935 (43 CFR, 297.11, 1949 ed.)

2. Lands withdrawn and reserved " in order to promote the highest use of the public lands pending its final disposal" by the process of establishing districts under the provisions of Section 1 of the Taylor Grazing Act (43 U. S. C. 315).

The essential features of these classes of lands is that they are reserved for particular purposes and withdrawn from private appropriation until opened to entry through the classification and associated processes. Essentially the same principles apply to vacant public lands in Alaska embraced in grazing leases (43 CFR 63.18, 63.22) but these latter lands have so far not been defined as being part of the National Land Reserve, since they are appropriated rather than reserved.

## Specific Land Classification Authority Exercised by the Bureau

The basic, specific land classification authority exercised by the Bureau is, ignoring some authorities of limited applicability, as follows:

1. Section 7 of the Taylor Grazing Act (43 U.S.C. 315f)
2. The Small Tract Act (43 U.S.C. 682a-c)
3. The Recreation and Public Purposes Act (43 U.S.C. 869 et seq.)
4. The Alaska Public Sales Act ( 48 U.S.C. 364a-3)
5. The Alaska Grazing Act ( 48 U.S.C. 471 et seq.) as interpreted (43 CFR, 63.18, 63.22).

The common features of all these authorities are

1. They are entirely discretionary. They are permissive and not mandatory.
2. The grant of authority is limited to lands having specific characteristics. The Secretary cannot legally go beyond those limitations in classifying land.

3. They apply only to certain classes of lands.

4. Classification of lands under any of the authorities opens the lands only to specific types of private appropriation.

5. Under some of the authorities, classification of lands can close the lands to nonconforming types of appropriation." 1/

1/ Land Review Statement No. 5 dated October 17, 1961

These facts are shown briefly on the following chart:

| Authority | Characteristics lands must have | Classes of land to which applicable | Effect with respect to private appropriation |
|---|---|---|---|
| Section 7 | Lands must be more valuable or suitable for the production of agricultural crops than for the production of native grasses and forage plants or lands must be more valuable or suitable for any other use than for the use provided for by the Taylor Grazing Act or lands must be proper for acquisition in satisfaction of any outstanding lieu, exchange, or scrip rights or land grant. | Public Domain managed by the Bureau of Land Management | Permits lands to be opened to appropriation consistent with the particular classification. |
| Small Tract Act. | Lands must be chiefly valuable for residence, recreation, business, or community site purposes. | Public Domain; Stock driveways and other reserved lands withdrawn by the Secretary pursuant to his statutory authority; vacant public lands; Alaska grazing lease lands. | Permits the lands to be opened to appropriation under the Small Tract Act; can close lands to other types of appropriation (43 CFR 257.3) |
| Recreation and Public Purposes Act. | No specific requirements in Recreation and Public Purposes Act itself; Section 7 applies outside of Alaska. | Public Domain; vacant public lands; Alaska grazing lease lands; Other Reserved lands except those excluded by the Act itself (43 U.S.C.869 (c) ) | Permits the land to be opened to appropriation under the Recreation and Public Purposes Act; can close lands to other types of appropriation ( 43 CFR 254.6) |
| Alaska Public Sale | Lands must be suitable for industrial or commercial purposes, including the construction of houses. | Vacant Public Lands; Alaska Grazing Lease Lands; Other Reserved lands except those excluded by the Act itself (48 U.S.C. 346 (a)) | Permits the lands to be opened to appropriation under Alaska Public Sale Act. |
| Alaska Grazing Act. | Lands must be suitable for the intended settlement, location, entry, or acquisition. (43 CFR 63.22) | Vacant public lands in Alaska appropriated by grazing leases. | Permits the lands to be opened to appropriation consistent with this particular classification |

Districts are included as: " All vacant public lands outside of Alaska but within grazing districts are withdrawn by provisions of Section 1 of the Taylor Grazing Act, as amended (43 U.S.C. 315). Such lands may not be leased or disposed of under the nonmineral public land laws unless and until the lands are determined to be proper for such lease or disposal by an authorized officer....."

Land Classification Policies.

" The general policy is to exercise the Secretary's discretionary authority to make or to decline to make favorable determinations in such a way as to promote the public interest. Accordingly, the advantages and disadvantages of any proposed classification will be analyzed from the viewpoint of the public interest in accordance with established policy"

Criteria For Retention of Public Lands.

In our classification, disposal or retention of land is paramount. The points which follow may guide you in your decision.

"The usual grounds for retention of vacant public lands are that there is a Federal interest in the lands which would be substantially violated by disposal.

A. Tracts to be retained may have characteristics similar to the following indicating a strong Federal interest:

(1) Of low use capability such that the land is not feasible of private ownership for any known purpose under ordinary economic conditions, and disposal to private ownership would be contrary to national land conservation policies (submarginal land).

(2) A "key tract" in relation to other Federal Lands which themselves are proper for retention; for example, a key tract providing water resources or access essential to the use and administration of adjacent public lands.

(3) A critical watershed protective site requiring Federal ownership to assure conservation objectives.

(4) A "key" recreational or wildlife site requiring Federal ownership to protect conservation values.

(5) Site of a Federal conservation project which has not been abandoned...

(6) Site of an unpatented mining claim which has been declared valid or apparently is valid.....

(7) Lands not eligible or appropriate for lease or disposal because of unavailability of a law authorizing appropriate disposal, lack of market or demand therefor, or other causes.

B. A tract should not be classified as proper for retention merely because it produces revenues for the Treasury or is at the time a part of a Federal land management program. For retention to be based upon interference with an essential Federal management program, the interference must be of such consequence that the program would be substantially damaged.

A tract should be classified as proper for retention on the grounds that it is essential as part of the program of a Federal agency other than the Bureau of Land Management, or is required for future transfer to a State or local agency unless one of the following conditions exists:

(1) The agency concerned has filed a valid application for the transfer or acquisition of the lands;

(2) Other information is of record indicating the agency's requirement and such requirement has been determined to be timely and proper; or

(3) Stated policies of the Department or Bureau require retention despite lack of expressed or known interest by a public agency.

"The public lands administered by the Department of the Interior through Bureau of Land Management are a vital national asset, a resource reserve to meet the needs of the present and future generations. Above all, it is a public asset. As administrators, we must be extremely circumspect in disposing of any part of it. We must be particularly on guard that we do not dissipate this public resource. Therefore, no lands will be disposed of unless there is a compelling reason to do so. In other words, there must be a positive showing that the disposition will be in the public interest. The burden of proof that a proposed disposition is in the public interest rests upon the person or group which makes the application or recommendation. So far as the Bureau is concerned, any real doubt will be resolved in favor of retention of the lands in public ownership.

While the Bureau is under no constraint to dispose of public lands, it is also under no constraint to withhold the disposition of public lands when disposition will be in the public interest. The Bureau will energetically attempt to meet all genuine needs for public lands when those needs can best be met from the National Land Reserve. It is also free to dispose of lands that it considers not needed in the National Land Reserve and it is in a position to dispose of them under favorable conditions. However, to extreme care will be used in determining the best method of disposition. Lands that are highly valuable for trading purposes will be retained for such purposes. This is discussed further below.....

In determining the appropriate disposition of lands of the National Land Reserve, the Bureau must give particular attention to present and prospective public values in the lands. Particular attention will be given to those values which are likely to be in short supply in the years to come. Already identified as having critical importance are lands having public recreational

waters, no matter how small or insignificant they may be individually. Only under the most rare of circumstances can lands and waters having public recreational values be transferred out of public availability.... The National Land Reserve must be considered as an important means of adding to the total supply of public value resources in short supply. Lands having special attractiveness so as to constitute highly desirable private property will be held as trading stock so far as possible to secure lands which have significant public values but held in private ownership. Opportunities to secure such public-value lands in trades will be seized with diligence no matter the agency of ultimate jurisdiction of the public-value lands which would be obtained by the trade.." 2/

2/ Land Review Statement No. 4 dated August 10, 1961

"A tract that is more valuable or suitable for the production of native grasses and forage plants than for the production of agricultural crops must be classified as improper for entry under the agricultural public land laws. See 43 CFR 296 1(a)."

Values may be affected also by unusual factors such as land i slands "Land islands often have added value because of the fact that the bulk of the land in the area has been taken off the open market and restricted to a special use. The value for other purposes has been concentrated in the few tracts that have not been so restricted...."

Examples of land islands are:

A. A tract adjoining or surrounded by a wild life refuge may be valuable as a hunting lodge.

B. A tract in a large forest area may be valuable as a camp site.

C. A tract in or adjoining a national park may be valuable as a site for concessions.

Where it has been determined that the production of timber is the highest use for which the land is presently suited, young forest reproduction shall be considered as an element which adds to the value of the land... When the highest use of the land is determined to be for purposes other than the production of timber young growth shall be considered as an element detracting from the value of the land for other purposes when the land would have to be cleared before being put to use." Obviously if the timber contributes to the aesthetic values it will influence values. "Site values should be recognized.... where they exist. Special features to recognize include:

A. Accessibility to lakes, rivers, or other bodies of water.

B. Strategic locations along highways.

C. Special scenic views.

D. Other special features which would add to the value of the land."

Values presented by Missouri River Basin Group reports are simply an indication based on physical inventory and are not an appraisal. "An appraisal is a judgment, determination or estimate based upon and supported by factual information. The validity of an appraisal is gaged by:

A. The factual data both physical and economic presented, and

B. The reasoning used by the appraiser in presenting his data."

Values.

We inventory and describe the area in land classification - and thereby get an idea of value. Elements of value include:

" A. Physical characteristics, such as

(1) Topography

(2) Soil types

(3) Cover

(4) Climate

(5) Timber

(6) Minerals

(7) Precipitation or other water source

B. Public Services such as:

(1) Roads and highways

(2) Railways

(3) Electric power and telephone

(4) Water

C. Neighborhood development such as:

(1) Accessibility to markets (populated centers)

(2) Accessibility to schools and churches.

D. Rights and restrictions such as:

(1) Appropriation or riparian water rights

(2) Easements or rights-of-way

(3) Zoning

(4) Crop acreage control

(5) Special permits

(6) Control over land use by electrical, irrigation, drainage, grazing or similar districts. "

Lands classification of the Missouri River Basin is reported on a series of forms which cover:

Part 1 Field Examiner's Conclusions

Part 2 Field Data

Part 3 .....

Part 4 Supplementary Materials.

Part 5 Comments

Part 6 Classification Statement.

Field Reports

"Land classification reports involve the following basic responsibilities:

A. The lands field examiners will be responsible for reporting all factual field data, making technical determinations for which they are professionally qualified and responsible, such as carrying capacities, appraised values, soil types, etc.; and preparing written conclusions and recommendations for the Classification Officers.

(1) This material will be presented in Parts One (Conclusion), Two (Field Data),..... and Four (Supplemental Materials.) (a) When supplemental field reports on matters such as timber volume and mineral character are required, they are included as part of the Supplemental Materials, Part Four. The supplementary reports may be prepared by the Lands field examiner if he is qualified, or by a specialist in the field involved."

"Part One, Field Examiner's Conclusion, Form 4-1499 (Fig.10 at end of section) is classified "For Administrative Use Only", this is mandatory in all Land Reports.

A. It is used by the field examiner to present his conclusions and

recommendations to aid the Classification Officer in determining the proper classification of the lands. It must be based upon and supported by the factual information recorded in Parts 2, and 4 of the Lands Report and inventory notes such as field writeup sheets. (Fig. 13)

B. The eight sections of the Conclusion Sheet are used follows:

(1) Name of applicant, fill in sub basin name i.e., Tongue River, Basin etc.

(2) Fill in Missouri River Basin - Land Classification

(3) Do not fill in

(4) Grazing or Forestry District in which the land is located.

(5) County in which land is located.

(6) State in which the land is located.

(7) Section 7 is used for a presentation of the legal description of the lands included in the report, organized in regular township and range style, and listed according to the investigator's conclusions and recommendations.... Estimated value is shown to the right of the acreage totals. An appropriate one line summary recommendation, such as "lands entry" must be placed above the description of each group of lands concerned.

.....

(8) Section 8 is used by the field examiner to give a statement which, .... ideally could be used practically verbatim in the Classification

Statement..... and again in the Land Office decision. This statement should be prepared with a great deal of care, and should consist of a brief and concise presentation of the factual basis for the recommendation, the basic reasoning supporting the recommendation, and the actual recommendation of the field examiner.

Part Two, Field Data, is used to present factual data regarding the land being examined, and to present technical determinations which the field examine is professionally qualified and responsible for making, (i.e. soil type, erosion, condition and carrying capacity of forage, etc.)

Form 4-1499a (Fig.12 at the end of this section)is to be used for this part whenever adequate. When not adequate, other forms of presentation may be devised locally such as straight narrative, fill in sheets, diagrams, and special forms. The check list (Fig.12) outline (1 through 8 under C below) should be consulted for any type presentation used to insure the inclusion of all necessary data.

The data on Form 4-1499a will be presented in a narrative form following the outline shown below and the check list of Fig.12.

(1) If sub-items in the checklists are not applicable, they need not be mentioned. If information can be better or more conveniently shown on a map, diagram, tabular statement, etc., this should be done, and appropriate references given in the narrative.

(2) A brief description of the various items listed is as follows:

(a) Background and General (Item 1) will be a concise statement giving background information of record which has a direct relation to the recommendations being made. It will describe the general character and location of the land and its social and economic environment..... It should be sufficient to give a reader a quick visual picture of the situation and the property involved.

(b) Occupancy Factors (Item 2) This section is used to show the present and past use of the land and names and addresses of authorized or unauthorized users.

(c) Crop Factors (Item 3) is used to discuss in detail the crop production potential of the land, if such potential is evident and is a pertinent factor. This item may be treated very briefly if a higher land use is evident, and crop production, while possible, is not important.

(d) Mineral Factors (Item 4) is used to show general observations of the investigator regarding existance of claims and mining activity. If a question of mineral character is involved, a separate detailed report should be prepared by a qualified mineral examiner, if the lands examiner is not fully qualified.

(e) Forestry Factors (Item 5) is used to discuss briefly the timber on the tract. If commercial timber is involved and it appears that a timber valuation is needed, a separate report should be prepared, giving the necessary data, (by a qualified forester if the field examiner is not so qualified). This item should be primarily concerned with the classification factors of management and use for the timber.

(f) Grazing Factors (Item 6) is used to show details of the lands grazing potential and use. This item should be discussed in detail if grazing is a significant use for the land. However, if a higher land use is evident, and grazing, while possible, is not significant, this item can be treated quite briefly. Any improvements on the land should be discussed in this section.

(g) Intensive Use Factors (Item 7) is very important when an intensive land use classification is recommended, such as recreation, residence, or commercial use. It is used to show the demand for intensive land use and the suitability of the land involved has no potential for intensive use.

Part Four, Supplementary Materials, Figure 14, is classified "public record" and is limited to maps, plats, photos, affidavits, statements, and other forms of exhibits. Whenever materials of this sort are included, it should be referred to in the appropriate parts of the report. If materials of a confidential nature are included, they should be prepared separately and marked " For Administrative Use Only". The use of colors should be minimized to facilitate photo copying.

A. The map or maps used should visually show the situation described briefly in the report. A map blank is provided, Form 4-1499 (Fig 14.)and should be used if appropriate. No data is placed on the back of this form, to facilitate tracing data onto the form. The map is a very important part of the report and should be very carefully prepared showing, if applicable, the area in general, adjoining land status, access, topography, culture, range types or cropland, delineations of areas having different values or recommendations, area land pattern or any other factors which are significant in the justification of the conclusions and recommendations.....

B. Photographs will be identified by describing the area shown, and the point from which they are taken.

C. Affidavits, letters, statements or other instruments are often necessary to support the examiner's conclusions and recommendations.

D. Supplemental reports as needed, showing timber volume, mineral character, etc., are included in this section so they can be properly considered in

the field examiner's conclusions and recommendations (Part One).

Summary

With the examination of lands completed, the material is presented in report form. Isolated tracts have been examined and the reports forwarded to the respective Land Offices. A summary is presented in the report, as Appendix A of the sub-basin report, see Fig.1.

This summary uses the special symbols below:

| Numerical designation denoting land use -- existing, potential, or proposed -- for use in isolated tract classification and for MRB Form 8, "Summarized Description, Classification and Appraisal of Public Domain Lands". | Numerical Designation of Land Uses. |
|---|---|
| Grazing | 1 |
| Crop Lands | 2 |
| Recreation | 3 |
| Game Range | 4 |
| Mining | 5 |
| Watershed Protection | 6 |
| Timber Production | 7 |
| Small Tract Areas (i.e., homesite, cabin, business, etc.) | 8 |
| Adjacent to live water | 9 |
| Submerged, water storage. | 10 |

Another set of symbols used in the summary are the following mineral symbols used on the same summary.

Evidence of mineral deposits for use on MRB Form 8, "Summarized Description, Classification and Appraisal of Public Domain Lands".

| Metallic Deposits | Mineral Symbols |
|---|---|
| Gold | Au |
| Silver | Ag |
| Copper | Cu |
| Lead | Pb |
| Zinc | Zn |
| Iron | Fe |
| Uranium | U |
| Manganese | Mn |
| Molybdenum | Mo |
| Sodium | Na |
| Pegmatite | Peg |

| Non-Metallic Deposits | Mineral Symbols |
|---|---|
| Gravel Pits | Gp |
| Bentonite | Bn |
| Limestone | Ls |
| Vermiculite | Vm |
| Gypsum | Gy |
| Lignite Coal | L. C. |
| Bituminous Coal | B. C. |

Show non-metallic deposits when being worked or of sufficient volume for commercial development.

When you make your statements:

"1. References are proper if they speak of classification of lands for lease, sale, or other disposition under a particular law or laws.

2. References are not proper if they speak of classification of lands not for lease, sale, or other disposition under a particular law or laws. They are proper, however, if they speak of findings that the lands cannot be classified for lease, sale, or disposition under a particular law or laws.

3. References are not proper if they speak of classification of lands for retention of lands in public ownership. They are proper, however, if they speak of the fact that the lands are reserved for specific public purposes ( where such is the case) and cannot be classified for lease, sale, or other disposition for certain stated reasons.

All statements governing classification may briefly give the reasons for the classification except that reason are mandatory when there are adverse parties. All statements governing inability to classify must contain reasons therefor, in such detail as circumstances require." 1/

1/ Land Review Statement No. 4 dated August 10, 1961.

The manual has a statement on reports which summarizes the necessary detailing.

"Lands classification reports are required to record the factual data, recommendations, and classifications for classification cases involving land use or title transfer, whether based on an application or based on Bureau Motion, in form and completeness sufficient to enable decisions to be made by appropriate Bureau Officers."

# Section XII

## Special Instructions and Tables

Form 4–1499
(April 1962)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

## LAND REPORT – FIELD EXAMINERS CONCLUSIONS

1. Applicant's Name and Address

Middle Yellowstone Basin

| 2. Type of Action or Application | 3. Serial Number(s) | 4. District | Miles City |
|---|---|---|---|
| MRB - LC | S-2 | 5. County | Custer |
| | | 6. State | Montana |

7. LANDS INVOLVED, SUMMARY LAND CAPABILITY CONCLUSIONS, CONCLUSION OF VALUE

| UNIT NO. | TWP. | RGE | MER. | SEC. | SUBDIVISION | ACRES | VALUE |
|---|---|---|---|---|---|---|---|
| S-2 | 3N | 49E | Mont. | 14 | NW 1/4 | 160 | $ 2400 |
| | | | | | Value is an estimation only and not an appraisal | | |
| | | | | | TOTALS | 160 | $ 2400 |

LAND REPORT FIELD EXAMINERS CONCLUSIONS

Figure 10.

## 8. LAND CAPABILITY CONCLUSIONS

This tract is best used for livestock grazing. Private land to the east between tract and the highway is posted " No Trespassing"; thus use by the public is cut off. Tract has no unique characteristics other than its location close to a paved highway. It's small size would not render it a good hunting area. I would recommend exchange or sale of this tract. Tract is surrounded by private land under single ownership.

I have personally examined and identified this property. I have no present or contemplated interest therein. The foregoing is true, to the best of my knowledge.

| (Signature of Examiner) | Range Conservationist (Title) | July 10, 19 (Date of report) |
|---|---|---|

GPO 854640

Figure 10.

Form 4–1499a
(April 1962)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

FIELD DATA

| | |
|---|---|
| Date of Field Examination | July 10, 1962 |
| Name of Applicant | MRB - LC |
| Serial Number | S-2 |

(Narrative report. Use checklist V BLM 6.8, Illustration 7)

The general character of this 160 acre tract of national land reserve can be described as moderately rolling grassland range. The tract is located approximately 1/8 mile west of highway 312 some 32 route miles S. E. of Miles City, Montana. This tract lies on the uplands west of highway 212 and Pumpkin Creek. A pickup truck trail across this tract from S. E. to N. W., commencing at highway 212 across from the Orcutt ranch headquarters.

The tract is grazed by livestock, along with pricately owned range to the south. Use is authorized by BLM Sec. 3 grazing permit issued by the Miles City District. Adjacent land on all sides is grassland range. Past use appears to have been the same as present.

Tract is not suitable for cropping, due to rolling topography, somewhat thinly developed soil, and occasional gravelly areas.

There is no evidence of minerals, mineral claims, or mineral exploration. Some gravel or cobblestone material is exposed on the soil surface on the bench tops.

No trees are located on this tract.

Basically a grassland aspect, although annual bromes comprise 20 percent of the composition. Other primary vegetative species are: Carex and bluestem wheatgrass. Range Condition is Fair. Vegetative density is 25 percent. Range Site is Thin Clayey. Land use capability is Class VII (rangeland with restricted use). Slopes are moderate. Erosion is slight to non-existent. The effective depth of the soil is mostly moderately deep (20 - 36") except for occasional shallow ridges. The texture of the topsoil is moderately heavy. The permeability of the second significant soil zone is slow. Parent material of the soil is sandstone, clay, and gravel. Precipitation runoff is slow. The stocking rate equals 7.1 surface acres per AUM or 23 AUM's for the entire tract.

Range improvements consist of a small stockwater pond in the S. E. corner of the tract. The tract is fenced on the northern and western boundaries and also approximately on the eastern boundary, although this fence is not on line.



Figure 11.

LAND REPORT
CHECKLIST FOR DATA SHEET

Item 1 - Background and General

a. Background information on record (area classification reports, previous decisions on land, formal negotations in advance of application, reference to prior report if this is supplemental, etc.)

b. Conflicts of record (other pending applications, short reference to any physical data conflict that may be described in one of the following paragraphs).

c. General character and location of land, (topography, vegetative aspects, method of identification tie to known vicinity).

d. Accessibility

e. General economy of vicinity (farming, ranching, resort, urban, etc).

f. Other general factors.

Item 2 - Occupancy Factors

a. Present occupancy, or use if any (name and address of authorized lessees and permittees* trespassers, or any other identifiable users of the land.

b. Present occupancy or use of adjacent lands

c. Historical use of area (observed or documented recreational, wildlife, grazing, crop production, or other use of lands).

d. Other occupancy factors.

* Fill in as to whether Section 15 lease or Section 3 permit, if addresses and names are unknown.

Item 3 - Crop Factors

a. Soils and rosion
b. Growing season
c. Precipitation - (amount, seasonal dist.)
   i - underground(depth, capacity, quality, drawdown, estimated recharge)
   ii - Surface (type, quality, quantity, appropriation) and water right (type-adequacy).
d. Usual cropping practices in area (type of crops, grown, method of cultivation, size of units, minimum size for economic family farm unit, extent of failures).

Item 4 - Mineral Factors

a. Conclusion of U.S.G.S. report
b. Evidence of claims (on ground or in county records).
c. Previous conclusions of experts.

Item 5 - Forestry Factors

a. Extent of timber (acreage, type).
b. Use of and demand for timber (shelter, recreation, post and pole production, commercial timber).
c. Management of timber (Bureau program, treatment given subject land, use as key tract).
d. Management of other timber in area.
e. Other forestry factors.

Item 6 - Grazing Factors

a. Vegetation (species, condition, carrying capacity in animal unit months per acre, and per subdivision when appropriate, range types, etc).

b. Range improvements (location, number, type, owner, age, condition, authorization).
c. Stock water (availability, quality, adequacy).
d. Use of tract in Bureau management program (key tract).

Figure 12.

Continued.

e. Effect of proposed action on local or ranch economy.

Item 7 - Intensive Use Factors

a. Demand for intensive use

b. Suitability for intensive use

i. Recreation possibility
ii. Residence possibilities
iii. Commercial or industrial possibilities
iv. Other intensive use, such as administrative sites etc.

Item 8 - Other Factors

Figure 12.

Front Side of Field Notes

Range Site & Condition Write-up
(Ecological Site Method)

10-14"

Date July 10, 1962

Plot No. S-2 Examiner R. C. Sherfey

T 3N R 49E Sec 14 P.M. Mont

1 Annual Bromes CAREX Agsm F 7.1 25%
Tcy VII C 1-1-1 3 F 2 FYZ 3

| Present Composition | | | Climax |
|---|---|---|---|
| Species | | % | % Usable |
| Grasses | Bogr | 10 | 10 |
| | CAREX | 15 | 10 |
| | Agsm | 10 | 10 |
| | Stco | 5 | |
| | Calo | T | |
| | Agsp | 10 | 10 |
| | Brte | 20 | |
| | Brja | | |
| | Fuoc | 5 | |
| | Pose | 10 | 5 |
| | Hoju | T | |
| Forbs | Plan | 5 | |
| | Arfr | | |
| | Psor | 5 | |
| | Weeds | | |
| | Arca | | |
| | Artr | | |
| Shrubs | Yucc | | |
| Total | | 100% | 45 % Condition |

GPO 840381

Photo 6744

.18 (.14) AUM's/Acre

Back of Field Notes for Explanation

This is a rolling grassland range. The area has scattered hills with gravelly tops dominated by CAREX and Bogr. The tract has permanent stockwater from a stockpond in the SE. corner.
Fenced on North and West with legal fence. Trail traverses this quarter section diagonally. Orcutt is Section 15 permittee. Tract is isolated and fenced into his pasture. No wildlife or recreational possibilities except waterfowl at damsite. Lowered stocking rate 1/2 precipitation zone for thin soiled site - Thin Clayey - see Technicians' Guide.

Figure 13. - Sample writeup chosen at random

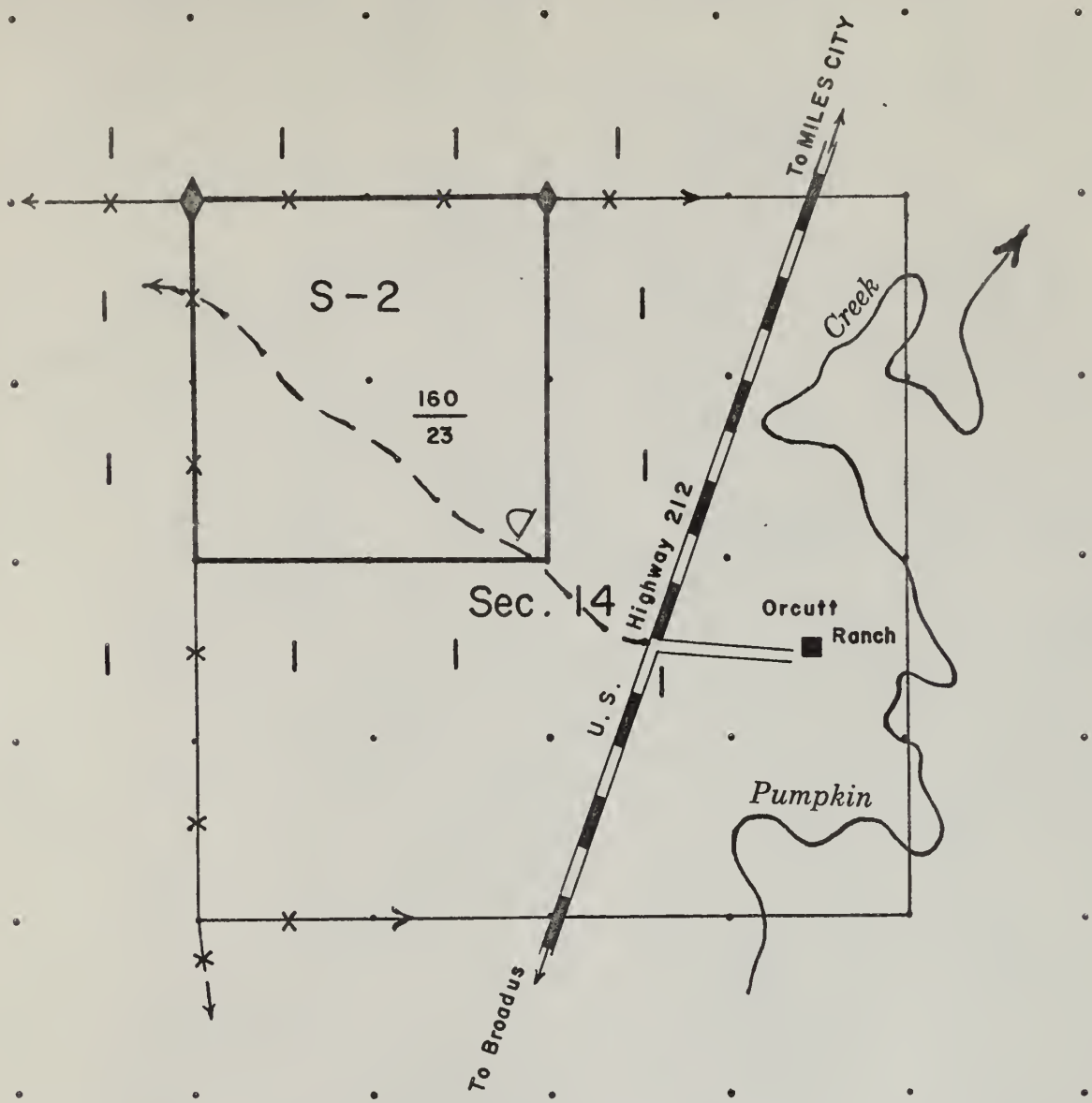
(April 1962)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

MAP

Serial Number S-2

Township 3 N., Range 49 E., Montana Meridian




LAND OWNERSHIP KEY AND ADDITIONAL TOPOGRAPHIC SYMBOLS

Scale: 1" = 1/4 Mile

| | | | |
|---|---|---|---|
| 1 | J. Bruce Orcutt | S-2 | Range Type No. |
| | 2450 So. Merriam Apt. 3 | 160 | Range Type Acreage |
| | Miles City, Mont. | 23 | AUM's |
| | | | |
| | | | |

OTHER DATA
Found Sec. Corner
1/4 Corner
Truck trail
Fence
Trakt boundary
Stock pond

LAND REPORT
Fig. 14

MAP

GPO 855223

I. PRIMARY AREA LAND CLASSIFICATION AND PLANNING

1. Physical Factors

a. Physiographic location (province and section or sections)
b. Areal geology (generalized)
c. Topography
   (1) General terrain conditions
   (2) Major topographic features
d. Drainage pattern
e. Limitations on land imposed by physiography

2. Climate

a. Climate location (climatic region or regions)
b. Climatic controls
c. Areal and seasonal distribution of normal annual precipitation
d. Variability of occurrence of precipitation
e. Average, maximum and minimum annual and seasonal temperatures
f. Length of frost-free growing period
g. Prevailing wind direction and velocity by seasons
h. Limitations on land use imposed by climate

3. Natural Vegetative Cover

a. Vegetative location (vegetative region or regions)
b. Range and forest vegetation
   (1) Distribution and description of cover types
   (2) Conditions and trends in cover type conditions

4. Soils
   a. Soils location
   b. Distribution and characteristics of soil series
   c. Limitations soils impose on land use

5. Land Classification (where available)

B. Economic and Social Factors

1. Cultural Development

a. Cities and towns
   (1) Population
   (2) Services rendered to the area

b. Public Facilities
   (1) Railroads
   (2) Principal roads
   (3) Dams and reservoirs
   (4) Industrial enterprises of importance
   (5) Other

c. Population
   (1) Total rural, farm and urban
   (2) Geographic distribution
   (3) Shifts and trends
   (4) Significant characteristics

2. Area Economy

   a. Economic development
   b. Major land use areas
      (1) Agricultural land
         (a) Principal farm land uses
            1/ Dry land agriculture
            2/ Irrigated agriculture

         (b) Types of farming areas

      (2) Forest land
      (3) Recreation areas
      (4) Wildlife areas
      (5) Urban areas
      (6) Other land use areas

   c. Industries
      (1)Agricultural resources industries
      (2)Forest, mining, recreation and other natural resources industries
      (3)Other industries and types of business

3. Land Ownership

   a. Amount of land by ownership type
      (1) Government
         (a) Federal
            1/ Public domain
               a/ Not leased, reserved or pending disposal
               b/ Leased or special land use permit
               c/ Disposal action pending
            2/ Public land programs
               a/ National forests
               b/ National parks
               c/ Grazing districts
               d/ Stock driveways
               e/ Fish and wildlife reservations
               f/ Irrigation projects
               g/ Other

         (b) State (if available)
            1/ State forests
            2/ State parks
            3/ Other

         (c) County (if available)

      (2) Private(relative amount if available)

4. Recognized land problems

a. Land use adjustment areas
(1) Grazing-farming reorganization
(2) Grazing management adjustment
(3) Irrigation-dry farming adjustment
(4) Farm reorganization (sizes, types, ownership, etc.)
(5) Forest management adjustments
(6) Public land program adjustment
(7) Other

b. Land problem areas

(1) Soil erosion
(2) Range depletion
(3) Forest depletion
(4) Floods and siltation
(5) Land abandonment
(6) Inadequate distribition of land improvements
(7) Inadequate distribution of water developments
(8) Other

II. SUB-AREA LAND CLASSIFICATION AND PLANNING

A. Physical Factors

1. Physiography

a. Physiographic location (province and action)
b. Areal geology (generalized)
c. Topography
(1) General terrain conditions
(2) Major topographic features
(3) Elevations and land slopes

d. Drainage pattern
(1) Major and minor streams
(2) Stream characteristics

e. Limitations physiography imposes on land use

2. Climate

a. Climatic location (climatic region)
b. Climatic controls
c. Precipitation
(1) Amount and distribution of normal annual rainfall
(2) Seasonal distribution of rainfall
(3) Variability of occurrence of precipitation
(4) Duration and intensity of rainfalls
(5) Snow season and average and extreme depth of snow.

d. Temperatures

(1) Normal and extreme monthly, seasonal and annual temperatures
(2) Length of frost-free growing season
    (a) Average, minimum, maximum, variability
    (b) Dates of last killing frost in spring and first killing frost in fall.

e. Wind
(1) Prevailing wind direction
(2) Monthly and seasonal average and maximum wind velocities

f. Evaporation
(1) Available evaporation data
(2) Average annual and seasonal evaporation

g. Limitations climate imposes on land use

3. Vegetative Cover

a. Vegetative location (vegetative region)
b. Natural vegetation
c. Range vegetation
(1) Distribution, description, and density of present vegetative types.
(2) Range conditions and trend in range conditions
(3) Grazing capacity of range lands
(4) Kind of stock to which adapted
(5) Season usable and growing season

d. Forest vegetation
(1) Distribution and description of forest types
(2) Degree of stocking and forest depletion
(3) Quality and volume of timber
(4) Forest and range relationships

4. Soils

a. Soils location (soil division)
b. Soil types, series, or groups
(1) Distribution
(2) Physical characteristics
    (a) Parent material
    (b) Structure
    (c) Texture
    (d) Depth
    (e) Organic matter content
    (f) Fertility
    (g) Erodibility
    (h) Infiltration and moisture holding capacity

c. Problem areas groups of soils
d. Conservation practices required on each soil type or group
e. Limitations soils impose on land use.

5. Water Resources

(c) Grazing land
1/ Range acreage
2/ Condition of range
3/ Present and potential carrying capacity
4/ Seasonal use of range

(2) Types of farming

(a) Principal types of farming under irrigation and non-irrigation
1/ Cropping systems and livestock enterprises
a/ Principal crops, average and variability of yields and production trends
b/ Cropping practices on farms
c/ Type and number of livestock grazed
d/ Operating methods of livestock enterprises
2/ Size of farms
a/ Adequacy as economic unit

(3) Effects of agriculture on soil and range resources

b. Forest land
(1) Amount of forest land
(2) Forest conditions as to type, volume, and stocking
(3) Forest utilization and products

c. Idle or abandoned land
(1) Amount of idle or abandoned land

d. Recreation areas
e. Urban Sites
f. Wildlife reservations
g. Other

3. Major Land Improvements

a. Irrigation
b. Drainage
c. Regrassing
d. Protection planting
e. Water spreading
f. Gully control operations
g. Water development
h. Stream stabilization
i. Range use facilities

4. Present Land Ownership and Operating Pattern

a. Amount of land ownership by type
(1) Private
(a) Resident
(b) Absentee

(2) Government
(a) Federal

1/ Public domain by status
2/ Other land programs by type

(b) State
(c) County

b. Effects of ownership on land use and conservation
c. Number and stability of full owners, part owners, and tenants
d. Leasing agreements and allotments in grazing districts and national forests
e. Area controlled by operators through ownership and leases

5. Land Values and Taxes

a. Approximate values of various classes of land
b. Effect of land values on land use
c. Amount of taxes per acre
d. Effect of taxes on land use

6. Markets and transportation

a. Distance and transportation to markets
b. Effects of markets and transportation on land use

C. Maladjustments in Land Use

1. Indicators of Maladjustment

a. Farm abandonment
b. Isolated settlements
c. Advanced soil erosion
d. Range depletion
e. Forest depletion
f. Flooding and silting
g. Past heavy tax delinquency
h. Excessive direct relief to farmers
i. Disrepair of farm homes and improvements

2. Land Use Maladjustment and Management Problems

a. Waste of natural resources
b. Defective grazing privilege apportionment
c. Deficient water facilities
d. Forest fire and disease hazards
e. Inadequate trails and driveways and trespassing
f. Defective land ownership operating unit pattern
g. Inadequate sized farms
h. Cultivation of poor land

3. Means of Land Use Adjustment and Improvement

a. Better distribution of land improvements
b. Modification of public and private land management practices
c. Possibilities of placing public lands in higher uses
d. Readjustment of land leases and grazing privileges
e. Adjusting public and private land ownership through land exchanges.
f. Coordination of use of public domain with use of patented lands, land programs of other Departmental agencies, and land programs of other federal,state, county, or local governmental agencies.

From Bureau of Land Management Manual, Volume 5 Lands, Part 6, Chapter 6.6

Radio Procedure

"Miles City - 802"(Missouri River Basin Group mobile radio is calling Miles City,) "Miles City"(reply from District.) Message is to be brief, use code below when applicable. Sentence finished, you wish them to answer,state "over". Finish message "802" and time on 24 hour basis,"1330"-(1.30 p.m.)

Portable sets are Missouri River Basin 1, - 2, etc. Mobile carset is 802.

BUREAU OF LAND MANAGEMENT
RADIO CODE

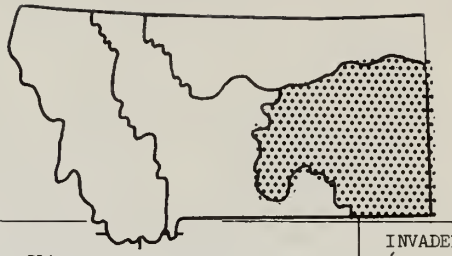
TEN- CODE

10-1 Receiving poorly
10-2 Receiving well
10-3 Stop transmitting
10-4 OK -- Acknowledgment
10-5 Verbal repeat
10-6 Standby (will call)
10-7 Out of service (radio turned off) ------- minutes
10-8 In Service (radio turned on)
10-9 Repeat beginning with ----------
10-11 Slow up (talking too fast)
10-13 Transmit weather information
10-19 Return to your station or -- am returning
10-20 What is your location ?
10-25 Do you have contact with ----?
10-33 Emergency traffic at this station
10-36 Correct time

4 - 1 All clear -- no fires
4 - 2 What is or this is, the burn index.
4 - 3 Leaving base on patrol flight
4 - 4 Arrived base on patrol flight or returning to base from patrol flight
4 - 7 I have fire traffice or do you have fire traffic?
4 - 8 Transmit short test call
4 - 9 What do you have to report ?
4 -11 Emergency fire call
4 -13 Arrived at scene of fire
4 -14 Can handle fire
4 -15 Fire under control
4 -16 Routine check-in
4 -17 We have no traffic for you.

Based on Information from
U. S. Department of Agriculture
Soil Conservation Service
(Rev) June, 1962

# TECHNICIANS' GUIDE TO RANGE SITES, CONDITION CLASSES AND RECOMMENDED STOCKING RATES IN THE SEDIMENTARY PLAINS OF MONTANA 10-14" PRECIPITATION ZONE



## PART I: KEY SPECIES AND THEIR RESPONSE TO GRAZING

| DECREASERS | | INCREASERS (By Range Sites*) | Maximum Percent by Dry Weight Produced Annually in Climax | | | | | | | | | | | | | | | | | | | | | | | | INVADERS (Less than 2½% in Climax) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WL | Sb | SS | Ov | SO | Sa | Sv | Sy | Si | Cy | TSy | TSi | TCy | SwC | SwG | SwL | SwN | Ps | DC | TB | Gr | Vs | SU | Sh | Bl | |
| Elci | Orhy | Agsm | - | 20 | d | 50 | d | 5 | 30 | 30 | d | d | d | d | d | d | d | d | d | d | d | d | d | d | d | d | d | Annual Plants |
| Spgr | Poca | Stco (1) | - | - | - | 5 | - | 25 | 20 | 45 | 40 | - | 45 | 40 | - | - | d | d | d | d | - | d | d | d | - | - | d | Phpr |
| Sppe | Puai | Spcr | - | - | - | - | - | 10 | 5 | 10 | 5 | - | 10 | 5 | - | - | 15 | 10 | 5 | 5 | - | d | d | d | - | - | d | Popr |
| Caca | Pudi | Kocr | - | - | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 10 | - | 10 | d | d | - | d | d | Sepa |
| Cain | Sedge decr. | Camo | - | - | - | - | - | - | 5 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | d | d | d | d | d | Musq |
| Elca | Forb decr. | Mucu | - | - | - | - | - | - | - | - | - | - | 5 | 10 | 10 | 5 | 10 | 10 | 10 | 5 | - | d | d | d | - | d | d | Hoju |
| Brma | | Bogr | - | - | - | 5 | - | 10 | 5 | 15 | 15 | 10 | 20 | 20 | 15 | 15 | 20 | 20 | 20 | 20 | - | 10 | 10 | 25 | - | d | d | Arlo |
| Bran | | Buda | - | - | - | - | - | - | - | - | - | 5 | - | - | 5 | - | - | - | - | 5 | 5 | - | - | - | - | - | - | Cael |
| Atca | | Pose | - | - | - | - | - | - | - | - | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | 5 | d | d | d | Grsq |
| Pavi | | Sihy | - | - | - | - | 5 | - | - | - | - | - | - | - | 5 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | - | d | d | d | Gusa |
| Spai | | Sedge incr. | 25 | 15 | 5 | 5 | - | 5 | 5 | 10 | 5 | 5 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 5 | - | 10 | d | d | - | d | d | Taof |
| Poar | | Dist | - | 5 | 15 | 5 | 25 | - | - | - | - | - | - | - | - | - | - | - | - | 5 | - | 5 | - | - | d | d | d | CIRS |
| Agsp | | Forb incr. | 10 | 10 | - | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | - | 5 | 5 | 10 | - | 15 | 5 | Arco (2) |
| Agsu | | Eula | - | - | - | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | d | d | d | d | d | d | d | d | d | d | d | Amar |
| Agin | | Atnu | - | - | - | - | 10 | - | - | - | 5 | 5 | - | 5 | 5 | 10 | - | 5 | - | 10 | - | 5 | - | - | d | d | d | CHRY |
| Agtr | | Artr | - | - | - | - | - | - | - | - | - | 5 | - | 5 | 5 | 5 | - | - | - | 5 | 5 | - | - | - | - | - | 5 | |
| Anha | | Atca | - | - | - | 5 | - | 5 | - | - | 5 | - | - | 5 | - | - | - | - | - | - | - | 5 | - | - | - | - | 5 | |
| Ange | | Save | - | - | 10 | - | 25 | - | - | - | - | 5 | - | - | - | 5 | - | - | - | 5 | 5 | 5 | - | - | 10 | 10 | d | |
| Ansc | | Conifers | - | - | - | - | - | - | 10 | - | - | - | - | - | - | 5 | - | 5 | 5 | - | - | 5 | 10 | 10 | - | - | 5 | |
| Bocu | | Other woody increasers | 10 | 15 | - | 10 | 5 | 10 | 5 | 5 | 5 | - | 5 | 5 | - | - | - | 5 | 5 | - | - | 5 | 5 | 5 | - | - | 5 | |
| Hemo | | Musq | - | 5 | 10 | 5 | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |

* The symbol "-" means the species has less than 2½% coverage or is not present in the original vegetation of this site. The symbol "d" means the species is a decreaser on this site. Range soil groups are described with the determinant features in the Technical Guide, WL - WETLANDS; Sb - SUBIRRIGATED; SS - SALINE SUBIRRIGATED; Ov - OVERFLOW; SO - SALINE OVERFLOW; Sa - SANDS; Sv - SAVANNAH; Sy - SANDY; Si - SILTY; Cy - CLAYEY; TSy - THIN SANDY; TSi - THIN SILTY; TCy - THIN CLAYEY; SwC - SHALLOW CLAY; SwG - SHALLOW TO GRAVEL ; SwL - SHALLOW LIMY; SwN - SHALLOW NONLIMY; Ps - PANSPOTS; DC - DENSE CLAY; TB - THIN BREAKS; Gr - GRAVEL; VS - VERY SHALLOW; SU - SALINE UPLAND; Sh - SHALE; Bl - BADLANDS.

## PART II: GUIDE FOR MAKING RECOMMENDATIONS ON STOCKING

A. Guide to Departures From Basic Table by Soil Groups **

For WET LAND sites use three times the values for 20-24" precipitation zone. For SUBIRRIGATED use two times the values for 20-24" p.z. For SALINE SUBIRRIGATED and OVERFLOW, use values of next higher p.z. For SALINE OVERFLOW use values one-half step above p.a. For SANDS, SAVANNAH, SANDY, SILTY and CLAYEY sites use values given for the p.z. For THIN SANDY, THIN SILTY, THIN CLAYEY, SHALLOW CLAY, SHALLOW TO GRAVEL, SHALLOW LIMY, SHALLOW NONLIMY, PANSPOTS and DENSE CLAY sites use values one-half to one zone lower than the p.z. where located. For THIN BREAKS use values one to one and one-half zones lower. For GRAVEL, VERY SHALLOW and SALINE UPLANDS use values one and one-half to two zones lower than those for the p.z. but not less than one-half the values for the 5-9" p.z. For SHALE and BADLANDS use values two to three zones lower but not less than one-half the values for the 5-9" precipitation zone.

B. Basic Table for Normal Sites of Each Precipitation Zone.

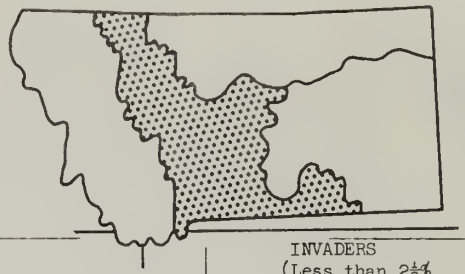
| Average Annual Precipitation Zone (Inches) | Range Condition Percentage & Classes (Animal Unit Months per Acre***) | | | |
|---|---|---|---|---|
| | 100 - EC | 75 - GC | 50 - FC | 25 - PC |
| 25 - 29 | 1.0 | .75 | .5 | .25 |
| 20 - 24 | .8 | .6 | .4 | .2 |
| 15 - 19 | .6 | .45 | .3 | .15 |
| 10 - 14 | .4 | .3 | .2 | .1 |
| 5 - 9 | .2 | .15 | .1 | .05 |

** Departures do not include utilization cuts because of inaccessibility. Apply any necessary utilization cut to grazing unit after AUM's are totaled.

*** All rates are much higher if grazing is limited to season of complete dormancy.

Based on information from
U. S. Department of Agriculture
Soil Conservation Service
(Rev) April, 1962

# TECHNICIANS' GUIDE TO RANGE SITES, CONDITION CLASSES AND RECOMMENDED STOCKING RATES IN THE FOOTHILLS AREA OF CENTRAL MONTANA 15-19" PRECIPITATION ZONE



## PART I: KEY SPECIES AND THEIR RESPONSE TO GRAZING

| DECREASERS | | INCREASERS (By Range Site*) | Maximum Percent Dry Weight Produced Annually in Climax | | | | | | | | | | | | | | | | | | | | | | INVADERS (Less than 2½% in Climax) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WL | Sb | SS | Ov | SO | Sa | Sv | Sy | Si | Cy | TSy | TSi | TCy | SwC | SwG | SwL | SwN | Ps | DC | TB | Gr | VS | SU | Sh | |
| Elci | Trsp | Agsm | - | 5 | d | 20 | d | - | 10 | 5 | 15 | 25 | 5 | 20 | 30 | d | d | 20 | 20 | d | 30 | 20 | d | d | d | d | Annual Plants |
| Spgr | Orhy | Feid | - | - | - | - | - | - | 20 | 15 | 20 | 20 | 20 | 25 | 25 | 25 | 30 | 30 | 30 | - | - | d | d | d | - | - | Phpr |
| Deca | Ansc | Stco (1) | - | - | - | - | - | 20 | 15 | 20 | 15 | - | 30 | 25 | - | - | 20 | 20 | 20 | d | - | 25 | d | d | - | - | Popr |
| Caca | Bocu | Spcr | - | - | - | - | - | 5 | - | 5 | - | - | 5 | - | - | - | 5 | - | - | - | - | 5 | 10 | d | - | - | Poco |
| Fesc | Poca | Dain | - | - | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | - | - | 5 | d | d | - | | Hoju |
| Elca | PUCC | Kocr | - | - | - | - | - | - | - | - | - | - | 5 | 5 | 5 | 5 | 10 | 10 | 10 | 5 | - | 5 | 5 | 5 | - | - | Sepa |
| Brma | Cahe | Camo | - | - | - | - | - | - | - | - | - | 5 | - | - | 5 | 5 | - | 5 | - | 10 | 15 | 10 | d | d | - | d | Arlo |
| Poam | Forb decr. | Bogr | - | - | - | - | - | - | - | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | 5 | 10 | 10 | - | d | Cael |
| Calo | Woody decr. | Pose | - | - | - | - | - | - | - | - | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | 10 | Grsq |
| Heki | | Sedge incr. | 25 | 15 | 10 | 10 | 10 | - | - | - | - | - | 5 | 5 | - | - | 5 | 5 | 5 | - | - | 5 | 5 | 10 | - | - | Gusa |
| Spai | | Musq | - | 5 | 5 | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | - | - | - | - | Taof |
| Poju | | ATRI | - | - | 10 | - | 20 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | d | d | Cila |
| Stvi | | Forb incr. | 15 | 15 | - | 10 | 5 | 10 | 10 | 10 | 10 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 5 | - | - | 10 | 15 | 5 | - | 10 | Ciar |
| Agsp | | Eula | - | - | - | - | - | - | - | - | - | 5 | - | - | - | 5 | - | - | - | d | - | d | - | - | - | d | Eues |
| Dapa | | Artr | - | - | - | - | - | - | - | - | 5 | - | - | 5 | - | - | - | - | - | - | - | 5 | - | | - | - | Cere |
| Agsu | | SAVE | - | - | - | - | 10 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 5 | CHRY |
| Agpa | | Conifers | - | 5 | - | - | - | - | 15 | - | - | - | - | - | - | 5 | 5 | 5 | 5 | - | - | 15 | 10 | 10 | 5 | | |
| Stcl | | Other woody plants | 10 | 15 | - | 15 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | - | 10 | 10 | 5 | | 5 | |

* The symbol "-" means the species has less than 2½% coverage or is not present in the original vegetation of this site. The symbol "d" means the species is a decreaser on this site. Range soil groups are described with determinant features in the Technical Guide. WL - WET LAND; Sb - SUBIRRIGATED; SS - SALINE SUBIRRIGATED; Ov - OVERFLOW; SO - SALINE OVERFLOW; Sa - SANDS; Sv - SAVANNAH; Sy - SANDY; Si - SILTY; Cy - CLAYEY; TSy - THIN SANDY; TSi - THIN SILTY; TCy - THIN CLAYEY; SwC - SHALLOW CLAY; SwG - SHALLOW TO GRAVEL; SwL - SHALLOW LIMY; SwN - SHALLOW NONLIMY; Ps - PANSPOTS; DC - DENSE CLAY; TB THIN BREAKS; Gr GRAVEL; VS - VERY SHALLOW; SU - SALINE UPLAND; Sh - SHALE.

## PART II: GUIDE FOR MAKING RECOMMENDATIONS ON STOCKING

A. Guide to departures from Basic Table by Soil Groups**

For WET LAND sites use three times the values for 20-24" precipitation zone. For SUBIRRIGATED use two times the values for 20-24" p.z. For SALINE SUBIRRIGATED and OVERFLOW, use values of next higher p.z. For SALINE OVERFLOW use values one-half step above p.z. For SANDS, SAVANNAH, SANDY, SILTY and CLAYEY sites use values given for the p.z. For THIN SANDY, THIN SILTY, THIN CLAYEY, SHALLOW CLAY, SHALLOW TO GRAVEL, SHALLOW LIMY, SHALLOW NONLIMY, PANSPOTS and DENSE CLAY sites use values one-half to one zone lower than the p.z. where located. For THIN BREAKS use values one to one and one-half zones lower. For GRAVEL, VERY SHALLOW and SALINE UPLANDS use values one and one-half to two zones lower than those for the p.z. but not less than one-half the values for the 5-9" p.z. For SHALE use values two to three zones lower but not less than one-half the values for the 5-9" precipitation zone.

B. Basic Table for Normal Sites of each Precipitation Zone.

| Average Annual Precipitation Zone | Range Condition Percentage and Classes | | | |
|---|---|---|---|---|
| | 100 | EC - 75 - GC | 50 - FC - 25 - PC | |
| (Inches) | (Animal Unit Months per Acre***) | | | |
| 25-29 | 1.0 | .75 | .5 | .25 |
| 20-24 | .8 | .6 | .4 | .2 |
| 15-19 | .6 | .45 | .3 | .15 |
| 10-14 | .4 | .3 | .2 | .1 |
| 5-9 | .2 | .15 | .1 | .05 |

** Departures do not include utilization cuts because of inaccessibility. Apply any necessary utilization cut to grazing unit after AUM's are totaled.

*** All rates are much higher if grazing is limited to season of complete dormancy.

RECOMMENDED STOCKING RATE
AUM'S PER ACRE

| Range Condition Percentage | Precipitation Belt (Inches) 25-29 | 20-24 | 15-19 | 10-14 | 5-9 |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | .05 | .04 | .03 | .02 | .01 |
| 10 | .10 | .08 | .06 | .04 | .02 |
| 15 | .15 | .12 | .09 | .06 | .03 |
| 20 | .20 | .16 | .12 | .08 | .04 |
| 25 | .25 | .20 | .15 | .10 | .05 |
| 30 | .30 | .24 | .18 | .12 | .06 |
| 35 | .35 | .28 | .21 | .14 | .07 |
| 40 | .40 | .32 | .24 | .16 | .08 |
| 45 | .45 | .36 | .27 | .18 | .09 |
| 50 | .50 | .40 | .30 | .20 | .10 |
| 55 | .55 | .44 | .33 | .22 | .11 |
| 60 | .60 | .48 | .36 | .24 | .12 |
| 65 | .65 | .52 | .39 | .26 | .13 |
| 70 | .70 | .56 | .42 | .28 | .14 |
| 75 | .75 | .60 | .45 | .30 | .15 |
| 80 | .80 | .64 | .48 | .32 | .16 |
| 85 | .85 | .68 | .51 | .34 | .17 |
| 90 | .90 | .72 | .54 | .36 | .18 |
| 95 | .95 | .76 | .57 | .38 | .19 |
| 100 | 1.00 | .80 | .60 | .40 | .20 |

CONVERSION FROM AUM'S PER ACRE

| Aum's Per Acre | Acres/ Aum | Aum's Per Acre | Acres/ Aum | Aum's Per Acre | Acres/ Aum | Aum's Per Acre | Acres/ Aum | Aum's Per Acre | Acres Aum |
|---|---|---|---|---|---|---|---|---|---|
| .01 | 100 | .21 | 4.8 | .41 | 2.4 | .61 | 1.6 | .81 | 1.2 |
| .02 | 50 | .22 | 4.5 | .42 | 2.4 | .62 | 1.6 | .82 | 1.2 |
| .03 | 33 | .23 | 4.3 | .43 | 2.3 | .63 | 1.6 | .83 | 1.2 |
| .04 | 25 | .24 | 4.2 | .44 | 2.3 | .64 | 1.6 | .84 | 1.2 |
| .05 | 20 | .25 | 4.0 | .45 | 2.2 | .65 | 1.5 | .85 | 1.2 |
| .06 | 17 | .26 | 3.8 | .46 | 2.2 | .66 | 1.5 | .86 | 1.2 |
| .07 | 14 | .27 | 3.7 | .47 | 2.1 | .67 | 1.5 | .87 | 1.1 |
| .08 | 13 | .28 | 3.6 | .48 | 2.1 | .68 | 1.5 | .88 | 1.1 |
| .09 | 11 | .29 | 3.4 | .49 | 2.0 | .69 | 1.4 | .89 | 1.1 |
| .10 | 10 | .30 | 3.3 | .50 | 2.0 | .70 | 1.4 | .90 | 1.1 |
| .11 | 9 | .31 | 3.2 | .51 | 2.0 | .71 | 1.4 | .91 | 1.1 |
| .12 | 8.3 | .32 | 3.1 | .52 | 1.9 | .72 | 1.4 | .92 | 1.1 |
| .13 | 7.7 | .33 | 3.0 | .53 | 1.9 | .73 | 1.4 | .93 | 1.1 |
| .14 | 7.1 | .34 | 2.9 | .54 | 1.9 | .74 | 1.4 | .94 | 1.1 |
| .15 | 6.7 | .35 | 2.9 | .55 | 1.8 | .75 | 1.3 | .95 | 1.1 |
| .16 | 6.3 | .36 | 2.8 | .56 | 1.8 | .76 | 1.3 | .96 | 1.0 |
| .17 | 5.9 | .37 | 2.7 | .57 | 1.8 | .77 | 1.3 | .97 | 1.0 |
| .18 | 5.6 | .38 | 2.6 | .58 | 1.7 | .78 | 1.3 | .98 | 1.0 |
| .19 | 5.3 | .39 | 2.6 | .59 | 1.7 | .79 | 1.3 | .99 | 1.0 |
| .20 | 5.0 | .40 | 2.5 | .60 | 1.7 | .80 | 1.3 | 1.00 | 1.0 |
| | | | | | | | | 1.20 | .8 |
| | | | | | | | | 2.00 | .5 |
| | | | | | | | | 5.00 | .2 |

INSTRUCTIONS TO TECHNICIANS: The use of the above guide will give you an indication of carrying capacity. However, other factors must be of record. On the back of each range writeup include the following as notes. However, all will not be within each type and will have to be noted. Record:

1. Site Inclusion: Inclusion of other Sites as minor constituents to the dominant Site with percent (%) of each.

2. Variance: Inclusion of areas of carrying capacity varying markedly from the site norm; such as, rocky outcrops, barren lakebeds or small productive meadows.

3. Soils: Explain if there are variations in soils which disagree markedly with the norm for the site--an area with severe erosion, for example.

4. Utilization Cut: Always record any cut which is made according to manual instructions in which feed is unavailable to stock because of rocks, distance of water, steep slope, down timber, unstable soil, etc.

5. Site Cut or Raise: Always record (if the site calls for another rainfall belt) how much of a deduction or addition has been made and for what reason, i.e. "cut one belt for Shallow". Sometimes carrying capacity is reduced because a less productive Site is included within the dominant more productive Site. Make the writeup according to percent of each (see 1 and 2).

6. Poisonous Plants: Are poisonous plants present? Are they significant; that is, do they constitute a menace and should they be eradicated?

7. Rodents: Are there destructive animals, such as prairie dogs or kangaroo rats or rabbits, in such numbers they need to be controlled?

8. Reaction to Site: It is especially important to give your impression of the Site; therefors, comment on the general aspect, if there is such a thing as scattered trees throughout the area, or perhaps a few included ridges on which limber pine may make this area different from the rest.

9. Recreation and Access: Record anything regarding recreational use, such as scenic beauty, hunting, fishing, or access to area which does provide such.

10. Inter-Agency Interest: Always mention archaelogical, paleontological or historical sites, or relict areas. They should be included on the map. Another factor which is sometimes overlooked are items of historical interest.

11. Potential Improvement: Is the area short of water? Is there permanent water or is there temporary water and how far distant? Is the forage underused because of lack of water? Is it overused because it is too close to water? Would it be possible to avoid overuse by better distribution of livestock; waterspreaders or reseeding?

RECOMMENDED STOCKING RATE
AUM'S PER ACRE

| Range Condition Percentage | Precipitation Belt (Inches) 25-29 | 20-24 | 15-19 | 10-14 | 5-9 |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | .05 | .04 | .03 | .02 | .01 |
| 10 | .10 | .08 | .06 | .04 | .02 |
| 15 | .15 | .12 | .09 | .06 | .03 |
| 20 | .20 | .16 | .12 | .08 | .04 |
| 25 | .25 | .20 | .15 | .10 | .05 |
| 30 | .30 | .24 | .18 | .12 | .06 |
| 35 | .35 | .28 | .21 | .14 | .07 |
| 40 | .40 | .32 | .24 | .16 | .08 |
| 45 | .45 | .36 | .27 | .18 | .09 |
| 50 | .50 | .40 | .30 | .20 | .10 |
| 55 | .55 | .44 | .33 | .22 | .11 |
| 60 | .60 | .48 | .36 | .24 | .12 |
| 65 | .65 | .52 | .39 | .26 | .13 |
| 70 | .70 | .56 | .42 | .28 | .14 |
| 75 | .75 | .60 | .45 | .30 | .15 |
| 80 | .80 | .64 | .48 | .32 | .16 |
| 85 | .85 | .68 | .51 | .34 | .17 |
| 90 | .90 | .72 | .54 | .36 | .18 |
| 95 | .95 | .76 | .57 | .38 | .19 |
| 100 | 1.00 | .80 | .60 | .40 | .20 |

CONVERSION FROM AUM'S PER ACRE

| Aum's Per Acre | Acres/ Aum | Aum's Per Acre | Acres/ Aum | Aum's Per Acre | Acres/ Aum | Aum's Per Acre | Acres/ Aum | Aum's Per Acre | Acres Aum |
|---|---|---|---|---|---|---|---|---|---|
| .01 | 100 | .21 | 4.8 | .41 | 2.4 | .61 | 1.6 | .81 | 1.2 |
| .02 | 50 | .22 | 4.5 | .42 | 2.4 | .62 | 1.6 | .82 | 1.2 |
| .03 | 33 | .23 | 4.3 | .43 | 2.3 | .63 | 1.6 | .83 | 1.2 |
| .04 | 25 | .24 | 4.2 | .44 | 2.3 | .64 | 1.6 | .84 | 1.2 |
| .05 | 20 | .25 | 4.0 | .45 | 2.2 | .65 | 1.5 | .85 | 1.2 |
| .06 | 17 | .26 | 3.8 | .46 | 2.2 | .66 | 1.5 | .86 | 1.2 |
| .07 | 14 | .27 | 3.7 | .47 | 2.1 | .67 | 1.5 | .87 | 1.1 |
| .08 | 13 | .28 | 3.6 | .48 | 2.1 | .68 | 1.5 | .88 | 1.1 |
| .09 | 11 | .29 | 3.4 | .49 | 2.0 | .69 | 1.4 | .89 | 1.1 |
| .10 | 10 | .30 | 3.3 | .50 | 2.0 | .70 | 1.4 | .90 | 1.1 |
| .11 | 9 | .31 | 3.2 | .51 | 2.0 | .71 | 1.4 | .91 | 1.1 |
| .12 | 8.3 | .32 | 3.1 | .52 | 1.9 | .72 | 1.4 | .92 | 1.1 |
| .13 | 7.7 | .33 | 3.0 | .53 | 1.9 | .73 | 1.4 | .93 | 1.1 |
| .14 | 7.1 | .34 | 2.9 | .54 | 1.9 | .74 | 1.4 | .94 | 1.1 |
| .15 | 6.7 | .35 | 2.9 | .55 | 1.8 | .75 | 1.3 | .95 | 1.1 |
| .16 | 6.3 | .36 | 2.8 | .56 | 1.8 | .76 | 1.3 | .96 | 1.0 |
| .17 | 5.9 | .37 | 2.7 | .57 | 1.8 | .77 | 1.3 | .97 | 1.0 |
| .18 | 5.6 | .38 | 2.6 | .58 | 1.7 | .78 | 1.3 | .98 | 1.0 |
| .19 | 5.3 | .39 | 2.6 | .59 | 1.7 | .79 | 1.3 | .99 | 1.0 |
| .20 | 5.0 | .40 | 2.5 | .60 | 1.7 | .80 | 1.3 | 1.00 | 1.0 |
| | | | | | | | | 1.20 | .8 |
| | | | | | | | | 2.00 | .5 |
| | | | | | | | | 5.00 | .2 |

INSTRUCTIONS TO TECHNICIANS: The use of the above guide will give you an indication of carrying capacity. However, other factors must be of record. On the back of each range writeup include the following as notes. However, all will not be within each type and will have to be noted. Record:

1. Site Inclusion: Inclusion of other Sites as minor constituents to the dominant Site with percent (%) of each.

2. Variance: Inclusion of areas of carrying capacity varying markedly from the site norm; such as, rocky outcrops, barren lakebeds or small productive meadows.

3. Soils: Explain if there are variations in soils which disagree markedly with the norm for the site--an area with severe erosion, for example.

4. Utilization Cut: Always record any cut which is made according to manual instructions in which feed is unavailable to stock because of rocks, distance of water, steep slope, down timber, unstable soil, etc.

5. Site Cut or Raise: Always record (if the site calls for another rainfall belt) how much of a deduction or addition has been made and for what reason, i.e. "cut one belt for Shallow". Sometimes carrying capacity is reduced because a less productive Site is included within the dominant more productive Site. Make the writeup according to percent of each (see 1 and 2).

6. Poisonous Plants: Are poisonous plants present? Are they significant; that is, do they constitute a menace and should they be eradicated?

7. Rodents: Are there destructive animals, such as prairie dogs or kangaroo rats or rabbits, in such numbers they need to be controlled?

8. Reaction to Site: It is especially important to give your impression of the Site; therefore, comment on the general aspect, if there is such a thing as scattered trees throughout the area, or perhaps a few included ridges on which limber pine may make this area different from the rest.

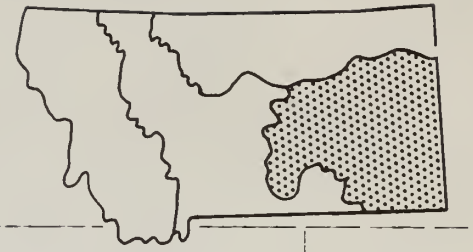
9. Recreation and Access: Record anything regarding recreational use, such as scenic beauty, hunting, fishing, or access to area which does provide such.

10. Inter-Agency Interest: Always mention archaelogical, paleontological or historical sites, or relict areas. They should be included on the map. Another factor which is sometimes overlooked are items of historical interest.

11. Potential Improvement: Is the area short of water? Is there permanent water or is there temporary water and how far distant? Is the forage underused because of lack of water? Is it overused because it is too close to water? Would it be possible to avoid overuse by better distribution of livestock; waterspreaders or reseeding?

Based on information from
U. S. Department of Agriculture
Soil Conservation Service
(Rev) April, 1962

# TECHNICIANS' GUIDE TO RANGE SITES, CONDITION CLASSES AND RECOMMENDED STOCKING RATES IN THE SEDIMENTARY PLAINS OF MONTANA 15-19" PRECIPITATION ZONE



PART I: Key Species and Their Response to Grazing

| DECREASERS | | INCREASERS (By Range Site*) | Maximum Percent Dry Weight Produced Annually in Climax | | | | | | | | | | | | | | | | | | | | | | | | INVADERS (Less than 2½% in Climax) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WL | Sb | SS | Ov | SO | Sa | Sv | Sy | Si | Cy | TSy | TSi | TCy | SwC | SwG | SwL | SwN | Ps | DC | TB | Gr | VS | SU | Sh | Bl | |
| Elci | Orhy | Agsm | - | 10 | d | 30 | d | 5 | 20 | 20 | 40 | 50 | 20 | 45 | 55 | d | d | d | d | d | d | d | d | d | d | d | d | Annual Plants |
| Spgr | Poca | Feid | - | - | - | - | - | - | 20 | 10 | 10 | 10 | 15 | 15 | 15 | 10 | 20 | d | d | - | - | d | d | d | - | - | - | Phpr |
| Sppe | Puai | Stco (1) | - | - | - | 5 | - | 20 | 15 | 25 | 20 | - | 30 | 25 | - | - | 20 | 20 | 20 | d | - | d | d | d | - | - | d | Popr |
| Caca | Pudi | Spor | - | - | - | - | - | 5 | - | 5 | 5 | - | 10 | 10 | - | - | 5 | - | - | - | - | 5 | 10 | d | - | - | - | Sepa |
| Cain | Sedge decr. | Dain | - | - | - | - | - | - | 5 | - | - | - | 5 | 5 | - | - | - | 5 | 5 | - | - | 5 | - | - | - | - | - | Musq |
| Elca | Forb decr. | Kocr | - | - | - | - | - | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | 5 | 5 | 5 | - | - | - | Hoju |
| Brma | | Camo | - | - | - | - | - | - | - | - | - | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | - | 5 | - | - | - | d | - | Arlo |
| Bran | | Mucu | - | - | - | - | - | - | - | - | - | - | 5 | 10 | 10 | 5 | 10 | 10 | 10 | - | - | 10 | 10 | d | - | d | d | Cael |
| Brca | | Bogr | - | - | - | - | - | 5 | 5 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 15 | 10 | 15 | - | 10 | 10 | 10 | - | d | 20 | Grsq |
| Brpu | | Buda | - | - | - | - | - | - | - | - | - | 5 | - | - | 5 | - | - | - | - | 5 | 5 | - | - | - | - | - | - | Gusa |
| Calo | | Pose | - | - | - | - | - | - | - | - | - | - | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | 10 | 10 | Taof |
| Stvi | | Sihy | - | - | - | - | 5 | - | - | - | - | - | - | - | 5 | 5 | - | - | - | 5 | 5 | - | - | - | 5 | 5 | - | CIRS |
| Agsp | | Sedge incr. | 25 | 15 | 10 | 5 | 5 | - | 5 | - | 5 | - | 10 | 10 | 5 | 5 | 10 | 5 | 5 | - | - | 10 | 10 | 10 | - | - | - | Arco (2) |
| Agsu | | Dist | - | - | 20 | - | 30 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | d | d | - | Amar |
| Agin | | Forb incr. | 15 | 15 | - | 10 | 5 | 10 | 10 | 10 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | - | - | 10 | 10 | 5 | - | 10 | 5 | CHRY |
| Agtr | | Eula | - | - | - | - | - | - | - | - | - | 5 | - | - | 5 | 5 | - | - | - | d | - | d | - | - | - | d | - | |
| Anha | | Artr | - | - | - | - | - | - | - | - | - | - | - | 5 | 5 | - | - | - | - | - | - | 5 | - | - | - | - | - | |
| Ange | | Arca | - | - | - | 5 | - | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | 5 | - | - | - | - | - | |
| Ansc | | Save | - | - | 5 | - | 10 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 5 | | |
| Bocu | | Conifers | - | - | - | - | - | - | 15 | - | - | - | 5 | 5 | - | 5 | 5 | 5 | 5 | - | - | 10 | - | 10 | - | 5 | - | |
| Hemo | | Other woody increasers | 10 | 15 | - | 15 | - | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | - | 5 | 5 | - | - | 5 | 5 | 5 | - | | 5 | |

*The symbol "-" means the species has less than 2½% coverage or is not present in the original vegetation of this site The symbol "d" means the species is a decreaser on this site. Range soil groups are described with determinant features in the Technical Guide, WL - WET LAND; Sb - SUBIRRIGATED; SS - SALINE SUBIRRIGATED; Ov - OVERFLOW; SO - SALINE OVERFLOW; Sa - SANDS; Sv - SAVANNAH; Sy - SANDY; Si - SILTY; Cy - CLAYEY; TSy - THIN SANDY; TSi - THIN SILTY; TCy - THIN CLAYEY; SwC - SHALLOW CLAY; SwG - SHALLOW TO GRAVEL; Swl - SHALLOW LIMY; SwN - SHALLOW NONLIMY; Ps - PANSPOTS; DC - DENSE CLAY: TB THIN BREAKS; Gr - GRAVEL; VS - VERY SHALLOW; SU - SALINE UPLANDS; Sh - SHALE ; Bl - BADLANDS.

PART II: GUIDE FOR MAKING RECOMMENDATIONS ON STOCKING

A. Guide to Departures From Basic Table by Soil Group**

For WET LAND sites use three times the values for 20-24" precipitation zone. For SUBIRRIGATED use two times the values for 20-24" p.z. For SALINE SUBIRRIGATED and OVERFLOW use values of next higher p.z. For SALINE OVERFLOW use values one-half step above p.z. For SANDS, SAVANNAH, SANDY, SILTY, and CLAYEY sites use values given for the p.z. For THIN SILTY, THIN CLAYEY, SHALLOW CLAY, SHALLOW TO GRAVEL, SHALLOW LIMY, SHALLOW NONLIMY, PANSPOTS and DENSE CLAY sites use values one-half to one zone lower than the p.z. where located. For THIN BREAKS use values one to one and one-half zones lower. For GRAVEL, VERY SHALLOW and SALINE UPLANDS use values one and one-halfto two zones lower than those for the p.z. but not less than one-half the values for the 5-9" p.z. For SHALE and BADLANDS use values two to three zones lower but not less than one-half the values for the 5-9"precipitation zone.

B. Basic Table for Normal Sites of Each Precipitation Zone.

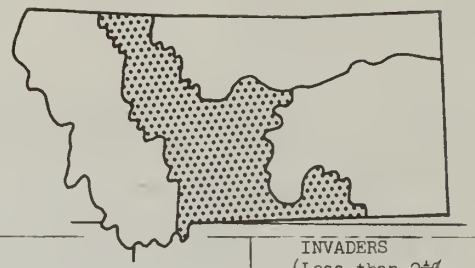
| Average Annual Precipitation Zone (Inches) | Range Condition Percentage & Classes 100 - EC - 75 - GC - 50 - FC - 25 - PC (Animal Unit Months per Acre ***) | | | |
|---|---|---|---|---|
| 25-29 | 1.0 | .75 | .5 | .25 |
| 20-24 | .8 | .6 | .4 | .2 |
| 15-19 | .6 | .45 | .3 | .15 |
| 10-14 | .4 | .3 | .2 | .1 |
| 5-9 | .2 | .15 | .1 | .05 |

** Departures do not include utilization cuts because of inaccessibility. Apply any necessary utilization cut to grazing unit after AUM's are totaled.

*** All rates are much higher if grazing is limited to season of complete dormancy.

Based on information from
U. S. Department of Agriculture
Soil Conservation Service
(Rev) April, 1962

# TECHNICIANS' GUIDE TO RANGE SITES, CONDITION CLASSES AND RECOMMENDED STOCKING RATES IN THE FOOTHILLS AREA OF CENTRAL MONTANA 10-14" PRECIPITATION ZONE



## PART I: KEY SPECIES AND THEIR RESPONSE TO GRAZING

| DECREASERS | | INCREASERS (By Range Site*) | Maximum Percent Dry Weight Produced Annually in Climax | | | | | | | | | | | | | | | | | | | | | | | INVADERS (Less than 2½% in Climax) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WL | Sb | SS | Ov | SO | Sa | Sv | Sy | Si | Cy | TSy | TSi | TCy | SwC | SwG | SwL | SwN | Ps | DC | TB | Gr | VS | SU | Sh | Bl | |
| Elci | Bocu | Agsm | - | 5 | d | 30 | d | 5 | 15 | 10 | 25 | 35 | 10 | 25 | 30 | d | d | 30 | 30 | d | 30 | 20 | d | d | d | d | d | Annual Plants |
| Spgr | Poca | Feid | - | - | - | - | - | - | d | d | 30 | d | d | d | d | d | d | d | d | - | - | d | d | d | d | d | - | Popr |
| Deca | PUCC | Stco (1) | - | - | - | 5 | - | 30 | 20 | 35 | 25 | - | 40 | 30 | - | - | d | 25 | 25 | d | - | d | d | d | - | - | d | Poco |
| Caca | Cahe | Spcr | - | - | - | - | - | 5 | - | 5 | - | - | 5 | - | - | - | 5 | - | - | - | - | 5 | 10 | d | - | - | - | Hoju |
| Fesc | Forb decr. | Kocr | - | - | - | - | - | 5 | 5 | 5 | 5 | - | 5 | 10 | 5 | 5 | 15 | 10 | 10 | 10 | - | 10 | d | d | - | - | - | Scpa |
| Elca | Woody decr. | Camo | - | - | - | - | - | - | 5 | 5 | 5 | 10 | 5 | 5 | 10 | 10 | d | d | d | 15 | 15 | d | d | d | - | d | - | Arlo |
| Brma | | Mucu | - | - | - | - | - | - | - | - | - | - | 10 | 15 | 5 | 5 | 15 | - | - | - | - | 10 | 10 | 15 | - | d | d | Cael |
| Poam | | Bogr | - | - | - | - | - | - | 5 | 5 | 10 | 5 | 10 | 10 | 5 | 5 | 10 | 10 | - | 10 | - | 10 | 15 | 15 | - | d | 25 | Grsq |
| Calo | | Pose | - | - | - | - | - | - | - | - | 5 | 5 | - | 5 | 10 | 10 | 10 | 10 | 10 | 10 | 5 | 10 | 10 | 10 | - | 10 | 10 | Gusa |
| Heki | | SITA | - | - | - | - | 10 | - | - | - | - | - | - | - | 5 | 5 | 5 | 5 | - | 5 | - | - | - | - | d | d | - | Taof |
| Spai | | Sedge incr. | 25 | 15 | 10 | 5 | 5 | - | - | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | 10 | d | d | - | - | - | Cila |
| Poju | | Musq | - | 5 | 10 | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | Ciar |
| Stvi | | ATRI | - | - | 15 | - | 30 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | d | d | - | Eues |
| Agsp | | Forb incr. | 10 | 10 | - | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | - | 5 | 10 | 15 | - | 15 | 5 | Cere |
| Dapa | | Eula | - | - | - | - | - | - | - | - | 10 | 5 | - | d | d | d | - | - | - | d | d | d | d | d | d | d | d | CHRY |
| Agtr | | Artr | - | - | - | - | - | - | - | - | 5 | 5 | - | 5 | - | 5 | - | - | - | - | - | 5 | - | - | - | - | - | |
| Stcl | | Arca | - | - | - | 5 | - | - | - | 5 | 5 | - | - | - | - | - | - | - | - | - | - | 5 | - | - | - | - | - | |
| Trsp | | SAVE | - | - | 5 | - | 20 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 10 | 10 | - | |
| Orhy | | Conifers | - | 5 | - | - | - | - | 10 | - | - | - | - | - | - | 5 | 5 | 5 | 5 | - | - | 10 | - | 5 | - | - | - | |
| Ansc | | Other woody plants | 10 | 15 | - | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | - | 5 | 5 | 5 | - | 5 | 5 | |

* The symbol "-" means the species has less than 2½% coverage or is not present in the original vegetation of this site. The symbol "d" means the species is a decreaser on this site. Range soil groups are described with determinant features in the Technical Guide. WL - WET LAND; Sb - SUBIRRIGATED; SS - SALINE SUBIRRIGATED; Ov - OVERFLOW; SO - SALINE OVERFLOW; Sa - SANDS; Sv - SAVANNAH; Sy - SANDY; Si - SILTY; Cy - CLAYEY; TSy - THIN SANDY; TSi - THIN SILTY; TCy - THIN CLAYEY; SwC - SHALLOW CLAY; SwG - SHALLOW TO GRAVEL; SwL - SHALLOW LIMY; SwN - SHALLOW NONLIMY; Ps - PANSPOTS; DC - DENSE CLAY; TB - THIN BREAKS; Gr - GRAVEL; VS - VERY SHALLOW; SU - SALINE UPLAND; Sh - SHALE; Bl - BADLANDS.

## PART II: GUIDE FOR MAKING RECOMMENDATIONS ON STOCKING

A. Guide to Departures from Basic Table by Soil Groups**

For WET LAND sites use three times the values for 20-24" precipitation zone. For SUBIRRIGATED use two times the values for 20-24" p.z. For SALINE SUBIRRIGATED and OVERFLOW, use values of next higher p.z. For SALINE OVERFLOW use values one-half step above p.z. For SANDS, SAVANNAH, SANDY, SILTY and CLAYEY sites use values given for the p.z. For THIN SANDY, THIN SILTY, THIN CLAYEY, SHALLOW CLAY, SHALLOW TO GRAVEL, SHALLOW LIMY, SHALLOW NONLIMY, PANSPOTS and DENSE CLAY sites use values one-half to one zone lower than the p.z. where located. For THIN BREAKS use values one to one and one-half zones lower. For GRAVEL, VERY SHALLOW, and SALINE UPLANDS use values one and one-half to two zones lower than those for the p.z. but not less than one-half the values for the 5-9" p.z. For SHALE and BADLANDS use values two to three zones lower but not less than one-half the values for the 5-9" precipitation zone.

B. Basic Table for Normal Sites of each Precipitation Zone

| Average Annual Precipitation Zone | Range Condition Percentage & Classes | | | |
|---|---|---|---|---|
| | 100 - EC | - 75 - GC - | 50 - FC - | 25 - PC |
| (Inches) | (Animal Unit Months per Acre***) | | | |
| 25-29 | 1.0 | .75 | .5 | .25 |
| 20-24 | .8 | .6 | .4 | .2 |
| 15-19 | .6 | .45 | .3 | .15 |
| 10-14 | .4 | .3 | .2 | .1 |
| 5-9 | .2 | .15 | .1 | .05 |

** Departures do not include utilization cuts because of inaccessibility. Apply any necessary itilization cut to grazing unit after AUM's are totaled.

*** All rates are much higher if grazing is limited to season of complete dormancy.

RECOMMENDED STOCKING RATE
AUM'S PER ACRE

| Range Condition Percentage | Precipitation Belt (Inches) 25-29 | 20-24 | 15-19 | 10-14 | 5-9 |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | .05 | .04 | .03 | .02 | .01 |
| 10 | .10 | .08 | .06 | .04 | .02 |
| 15 | .15 | .12 | .09 | .06 | .03 |
| 20 | .20 | .16 | .12 | .08 | .04 |
| 25 | .25 | .20 | .15 | .10 | .05 |
| 30 | .30 | .24 | .18 | .12 | .06 |
| 35 | .35 | .28 | .21 | .14 | .07 |
| 40 | .40 | .32 | .24 | .16 | .08 |
| 45 | .45 | .36 | .27 | .18 | .09 |
| 50 | .50 | .40 | .30 | .20 | .10 |
| 55 | .55 | .44 | .33 | .22 | .11 |
| 60 | .60 | .48 | .36 | .24 | .12 |
| 65 | .65 | .52 | .39 | .26 | .13 |
| 70 | .70 | .56 | .42 | .28 | .14 |
| 75 | .75 | .60 | .45 | .30 | .15 |
| 80 | .80 | .64 | .48 | .32 | .16 |
| 85 | .85 | .68 | .51 | .34 | .17 |
| 90 | .90 | .72 | .54 | .36 | .18 |
| 95 | .95 | .76 | .57 | .38 | .19 |
| 100 | 1.00 | .80 | .60 | .40 | .20 |

CONVERSION FROM AUM'S PER ACRE

| Aum's Per Acre | Acres/ Aum | Aum's Per Acre | Acres/ Aum | Aum's Per Acre | Acres/ Aum | Aum's Per Acre | Acres/ Aum | Aum's Per Acre | Acres Aum |
|---|---|---|---|---|---|---|---|---|---|
| .01 | 100 | .21 | 4.8 | .41 | 2.4 | .61 | 1.6 | .81 | 1.2 |
| .02 | 50 | .22 | 4.5 | .42 | 2.4 | .62 | 1.6 | .82 | 1.2 |
| .03 | 33 | .23 | 4.3 | .43 | 2.3 | .63 | 1.6 | .83 | 1.2 |
| .04 | 25 | .24 | 4.2 | .44 | 2.3 | .64 | 1.6 | .84 | 1.2 |
| .05 | 20 | .25 | 4.0 | .45 | 2.2 | .65 | 1.5 | .85 | 1.2 |
| .06 | 17 | .26 | 3.8 | .46 | 2.2 | .66 | 1.5 | .86 | 1.2 |
| .07 | 14 | .27 | 3.7 | .47 | 2.1 | .67 | 1.5 | .87 | 1.1 |
| .08 | 13 | .28 | 3.6 | .48 | 2.1 | .68 | 1.5 | .88 | 1.1 |
| .09 | 11 | .29 | 3.4 | .49 | 2.0 | .69 | 1.4 | .89 | 1.1 |
| .10 | 10 | .30 | 3.3 | .50 | 2.0 | .70 | 1.4 | .90 | 1.1 |
| .11 | 9 | .31 | 3.2 | .51 | 2.0 | .71 | 1.4 | .91 | 1.1 |
| .12 | 8.3 | .32 | 3.1 | .52 | 1.9 | .72 | 1.4 | .92 | 1.1 |
| .13 | 7.7 | .33 | 3.0 | .53 | 1.9 | .73 | 1.4 | .93 | 1.1 |
| .14 | 7.1 | .34 | 2.9 | .54 | 1.9 | .74 | 1.4 | .94 | 1.1 |
| .15 | 6.7 | .35 | 2.9 | .55 | 1.8 | .75 | 1.3 | .95 | 1.1 |
| .16 | 6.3 | .36 | 2.8 | .56 | 1.8 | .76 | 1.3 | .96 | 1.0 |
| .17 | 5.9 | .37 | 2.7 | .57 | 1.8 | .77 | 1.3 | .97 | 1.0 |
| .18 | 5.6 | .38 | 2.6 | .58 | 1.7 | .78 | 1.3 | .98 | 1.0 |
| .19 | 5.3 | .39 | 2.6 | .59 | 1.7 | .79 | 1.3 | .99 | 1.0 |
| .20 | 5.0 | .40 | 2.5 | .60 | 1.7 | .80 | 1.3 | 1.00 | 1.0 |
| | | | | | | | | 1.20 | .8 |
| | | | | | | | | 2.00 | .5 |
| | | | | | | | | 5.00 | .2 |

INSTRUCTIONS TO TECHNICIANS: The use of the above guide will give you an indication of carrying capacity. However, other factors must be of record. On the back of each range writeup include the following as notes. However, all will not be within each type and will have to be noted. Record:

1. Site Inclusion: Inclusion of other Sites as minor constituents to the dominant Site with percent (%) of each.

2. Variance: Inclusion of areas of carrying capacity varying markedly from the site norm; such as, rocky outcrops, barren lakebeds or small productive meadows.

3. Soils: Explain if there are variations in soils which disagree markedly with the norm for the site--an area with severe erosion, for example.

4. Utilization Cut: Always record any cut which is made according to manual instructions in which feed is unavailable to stock because of rocks, distance of water, steep slope, down timber, unstable soil, etc.

5. Site Cut or Raise: Always record (if the site calls for another rainfall belt) how much of a deduction or addition has been made and for what reason, i.e. "cut one belt for Shallow". Sometimes carrying capacity is reduced because a less productive Site is included within the dominant more productive Site. Make the writeup according to percent of each (see 1 and 2).

6. Poisonous Plants: Are poisonous plants present? Are they significant; that is, do they constitute a menace and should they be eradicated?

7. Rodents: Are there destructive animals, such as prairie dogs or kangaroo rats or rabbits, in such numbers they need to be controlled?

8. Reaction to Site: It is especially important to give your impression of the Site; therefore, comment on the general aspect, if there is such a thing as scattered trees throughout the area, or perhaps a few included ridges on which limber pine may make this area different from the rest.

9. Recreation and Access: Record anything regarding recreational use, such as scenic beauty, hunting, fishing, or access to area which does provide such.

10. Inter-Agency Interest: Always mention archaelogical, paleontological or historical sites, or relict areas. They should be included on the map. Another factor which is sometimes overlooked are items of historical interest.

11. Potential Improvement: Is the area short of water? Is there permanent water or is there temporary water and how far distant? Is the forage underused because of lack of water? Is it overused because it is too close to water? Would it be possible to avoid overuse by better distribution of livestock; waterspreaders or reseeding?

RECOMMENDED STOCKING RATE
AUM'S PER ACRE

| Range Condition Percentage | Precipitation Belt (Inches) 25-29 | 20-24 | 15-19 | 10-14 | 5-9 |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | .05 | .04 | .03 | .02 | .01 |
| 10 | .10 | .08 | .06 | .04 | .02 |
| 15 | .15 | .12 | .09 | .06 | .03 |
| 20 | .20 | .16 | .12 | .08 | .04 |
| 25 | .25 | .20 | .15 | .10 | .05 |
| 30 | .30 | .24 | .18 | .12 | .06 |
| 35 | .35 | .28 | .21 | .14 | .07 |
| 40 | .40 | .32 | .24 | .16 | .08 |
| 45 | .45 | .36 | .27 | .18 | .09 |
| 50 | .50 | .40 | .30 | .20 | .10 |
| 55 | .55 | .44 | .33 | .22 | .11 |
| 60 | .60 | .48 | .36 | .24 | .12 |
| 65 | .65 | .52 | .39 | .26 | .13 |
| 70 | .70 | .56 | .42 | .28 | .14 |
| 75 | .75 | .60 | .45 | .30 | .15 |
| 80 | .80 | .64 | .48 | .32 | .16 |
| 85 | .85 | .68 | .51 | .34 | .17 |
| 90 | .90 | .72 | .54 | .36 | .18 |
| 95 | .95 | .76 | .57 | .38 | .19 |
| 100 | 1.00 | .80 | .60 | .40 | .20 |

CONVERSION FROM AUM'S PER ACRE

| Aum's Per Acre | Acres/ Aum | Aum's Per Acre | Acres/ Aum | Aum's Per Acre | Acres/ Aum | Aum's Per Acre | Acres/ Aum | Aum's Per Acre | Acres Aum |
|---|---|---|---|---|---|---|---|---|---|
| .01 | 100 | .21 | 4.8 | .41 | 2.4 | .61 | 1.6 | .81 | 1.2 |
| .02 | 50 | .22 | 4.5 | .42 | 2.4 | .62 | 1.6 | .82 | 1.2 |
| .03 | 33 | .23 | 4.3 | .43 | 2.3 | .63 | 1.6 | .83 | 1.2 |
| .04 | 25 | .24 | 4.2 | .44 | 2.3 | .64 | 1.6 | .84 | 1.2 |
| .05 | 20 | .25 | 4.0 | .45 | 2.2 | .65 | 1.5 | .85 | 1.2 |
| .06 | 17 | .26 | 3.8 | .46 | 2.2 | .66 | 1.5 | .86 | 1.2 |
| .07 | 14 | .27 | 3.7 | .47 | 2.1 | .67 | 1.5 | .87 | 1.1 |
| .08 | 13 | .28 | 3.6 | .48 | 2.1 | .68 | 1.5 | .88 | 1.1 |
| .09 | 11 | .29 | 3.4 | .49 | 2.0 | .69 | 1.4 | .89 | 1.1 |
| .10 | 10 | .30 | 3.3 | .50 | 2.0 | .70 | 1.4 | .90 | 1.1 |
| .11 | 9 | .31 | 3.2 | .51 | 2.0 | .71 | 1.4 | .91 | 1.1 |
| .12 | 8.3 | .32 | 3.1 | .52 | 1.9 | .72 | 1.4 | .92 | 1.1 |
| .13 | 7.7 | .33 | 3.0 | .53 | 1.9 | .73 | 1.4 | .93 | 1.1 |
| .14 | 7.1 | .34 | 2.9 | .54 | 1.9 | .74 | 1.4 | .94 | 1.1 |
| .15 | 6.7 | .35 | 2.9 | .55 | 1.8 | .75 | 1.3 | .95 | 1.1 |
| .16 | 6.3 | .36 | 2.8 | .56 | 1.8 | .76 | 1.3 | .96 | 1.0 |
| .17 | 5.9 | .37 | 2.7 | .57 | 1.8 | .77 | 1.3 | .97 | 1.0 |
| .18 | 5.6 | .38 | 2.6 | .58 | 1.7 | .78 | 1.3 | .98 | 1.0 |
| .19 | 5.3 | .39 | 2.6 | .59 | 1.7 | .79 | 1.3 | .99 | 1.0 |
| .20 | 5.0 | .40 | 2.5 | .60 | 1.7 | .80 | 1.3 | 1.00 | 1.0 |
| | | | | | | | | 1.20 | .8 |
| | | | | | | | | 2.00 | .5 |
| | | | | | | | | 5.00 | .2 |

INSTRUCTIONS TO TECHNICIANS: The use of the above guide will give you an indication of carrying capacity. However, other factors must be of record. On the back of each range writeup include the following as notes. However, all will not be within each type and will have to be noted. Record:

1. Site Inclusion: Inclusion of other Sites as minor constituents to the dominant Site with percent (%) of each.

2. Variance: Inclusion of areas of carrying capacity varying markedly from the site norm; such as, rocky outcrops, barren lakebeds or small productive meadows.

3. Soils: Explain if there are variations in soils which disagree markedly with the norm for the site--an area with severe erosion, for example.

4. Utilization Cut: Always record any cut which is made according to manual instructions in which feed is unavailable to stock because of rocks, distance of water, steep slope, down timber, unstable soil, etc.

5. Site Cut or Raise: Always record (if the site calls for another rainfall belt) how much of a deduction or addition has been made and for what reason, i.e. "cut one belt for Shallow". Sometimes carrying capacity is reduced because a less productive Site is included within the dominant more productive Site. Make the writeup according to percent of each (see 1 and 2).

6. Poisonous Plants: Are poisonous plants present? Are they significant; that is, do they constitute a menace and should they be eradicated?

7. Rodents: Are there destructive animals, such as prairie dogs or kangaroo rats or rabbits, in such numbers they need to be controlled?

8. Reaction to Site: It is especially important to give your impression of the Site; therefore, comment on the general aspect, if there is such a thing as scattered trees throughout the area, or perhaps a few included ridges on which limber pine may make this area different from the rest.

9. Recreation and Access: Record anything regarding recreational use, such as scenic beauty, hunting, fishing, or access to area which does provide such.

10. Inter-Agency Interest: Always mention archaelogical, paleontological or historical sites, or relict areas. They should be included on the map. Another factor which is sometimes overlooked are items of historical interest.

11. Potential Improvement: Is the area short of water? Is there permanent water or is there temporary water and how far distant? Is the forage underused because of lack of water? Is it overused because it is too close to water? Would it be possible to avoid overuse by better distribution of livestock; waterspreaders or reseeding?